

DEPARTMENT OF THE INTERIOR

ANNUAL REPORT

OF THE

TOPOGRAPHICAL SURVEYS
BRANCH

1917-18

PRINTED BY ORDER OF PARLIAMENT



OTTAWA

J. DE LABROQUERIE TACHÉ,
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY

1919

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REPORT

OF THE

TOPOGRAPHICAL SURVEYS BRANCH

INTRODUCTION.

The work of the Topographical Surveys has been classified under two headings, "Field Work" and "Office Work."

Appendices exhibit the total area subdivided, the detailed work of each surveyor, the mileage and cost, a statistical summary of office work, a schedule of latitude observations, and a statement of instruments on hand.

An outstanding feature of the year's work was the revision of the Manual of Instructions for surveys. This was rendered necessary by the adoption of a new method for township subdivision, and other changes.

PART I—FIELD WORK.

The amount appropriated by Parliament for the survey of Dominion lands was \$776,300 or \$200,000 less than the preceding year. However, by the exercise of rigid economy and by dispensing with surveys which were not urgent the department succeeded in reducing the expenditure for the fiscal year to about \$657,000.

Only forty-one parties were employed, as compared with sixty-five in 1915 and fifty in 1916. Of these forty-one parties, four worked in Manitoba, eleven in Saskatchewan, thirteen in Alberta, six in British Columbia, and seven partly in one province and partly in another. Of the six parties in British Columbia, four were employed in the railway belt and two in what is known as the Peace River block. The size of the parties was also considerably reduced and, as far as possible, men suitable for enlistment or farm work were not engaged.

The standard meridians which form the governing lines for all surveys in Western Canada are run due north four degrees or about 180 miles apart at the international boundary.

These meridians are connected every twenty-four miles by base lines, from which the subdivision lines are run. Under the previous system of subdivision the outlines of the townships were run north and south from the base lines, and were the controlling lines for the subdivision of the township. The north and south boundaries were established by joining opposite township corners.

Under the new system the central meridian of a township is run first. It is chained and check chained, before the monuments are established. From this control meridian the remaining chords are accurately turned off and produced as straight lines to the township outlines. Section and township corners are placed at the intersection of the chords and remaining meridians. The new method has proved most satisfactory in every respect.

BASE LINE SURVEYS.

The question has frequently been asked, "Why is it necessary to produce base lines and meridians so far beyond subdivision and general settlement?" These lines are needed for starting and controlling all other surveys. As their establishment takes several years, they have to be surveyed far in advance of settlement in order that subdivision and other surveys may be undertaken at any time and in any part of the country, whenever the necessity arises. Such good progress has been made in this programme that three base line parties were sufficient to complete the surveys required for the year. The total mileage surveyed was 446 miles, being 122 miles less than for the preceding year.

Party No. 1—Surveys North of The Pas.

This party surveyed portions of the 17th base line west of the Principal meridian and the interprovincial boundary between Manitoba and Saskatchewan.

PERSONNEL:

T. H. Plunkett, D.L.S., in charge.

Assistants—

C. S. Macdonald, D.L.S.
D. O. Wing, D.L.S.

Leveller—

A. Matheson, D.L.S.

Party—

20 employees.

This survey is particularly useful on account of the valuable copper mines in operation at Schist, Flinflon and Amisk lakes. The rich ore from the Flinflon district is transported from the mines partly over wagon and sleigh roads and partly by boat to The Pas, some seventy miles to the south, from which point it is shipped by rail to British Columbia for smelting.

Some good timber grows along the shores of lakes and rivers, consisting of spruce and jack pine. Back from the lakes the perpetual frost preserved by its protecting covering of moss stunts the growth of the trees. Mining, fishing, and lumbering are the important industries of this district; the only land suitable for agriculture is a small amount around Sturgeon Landing.

West of Reed lake the country is high and dry; it is in this rocky formation that the minerals are found which make this district a valuable mining area.

Party No. 2.—Surveys in Northwestern Saskatchewan.

A few short portions of base lines were surveyed easterly from the Fourth meridian in the Buffalo lake district. This district

PERSONNEL:

G. H. Blanchet, D.L.S., in charge.

Assistants—

A. Matheson, D.L.S.
E. A. Petrie.

Leveller—

R. Lawrence.

Party—

20 employees.

is easily accessible both from the west over the Alberta and Great Waterways railway, and from the east over water routes from the Canadian Northern terminus at Big River.

The townships which may be subdivided by running from these base lines contain some good hay flats along the rivers, the remainder being hilly country or muskegs interspersed with poplar and jack pine ridges. To the north and east of the locality where the survey of these lines was discontinued are sand hills covered with jack pine which have been extensively burned over. The base lines surveyed lie mostly in the area drained by Churchill river.

The divide between the basins of Churchill and Athabaska rivers follows along the Fourth meridian generally. Muskegs in this area are numerous and on account of their slow drainage tend to keep the streams at a fairly uniform level throughout the year. Forest fires are also kept considerably in check by the muskegs, and good patches of merchantable timber are found.

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A certain historical interest is attached to this district. The early trader-explorers in going from tidal water at Hudson bay inland in search of new fields for their fur trade travelled up Churchill river and ultimately reached those lakes forming its headwaters. From there it was found that a short portage from Methy lake led into a new watershed, with rivers draining northward into the Arctic. It was by this route that Sir Alexander Mackenzie travelled when he first made his important discoveries and found the river which now bears his name. Later, Thompson passed this way on his famous trip to the Pacific by way of Peace and Fraser rivers. Trading posts were established in the Mackenzie basin as a result of these explorations, and as water transportation was essential for goods and furs the first great transcontinental route was formed of Churchill and Mackenzie rivers and their tributaries, uniting at the twelve-mile portage from Methy lake to Clearwater river. Half-way across this portage the canoe men from the east met those from the north and west, trade goods were exchanged for furs and each party returned the way it had come; only one round trip was made each year.

After the Canadian Pacific railway was built this route was abandoned in favour of Athabaska river, and now this has been itself superseded by the Peace River route. Since the construction of the Alberta and Great Waterways railway there is a possibility of the old Churchill river route coming into use again with the direction of trade reversed, furs going west and goods east.

Party No. 3—Surveys South of Lake Athabaska.

The 28th base line between the Fourth and Fifth meridians was run by this party, thus completing the survey of all the base lines between these meridians south of lake Athabaska.

PERSONNEL:

J. R. Akins, D.L.S., in charge.

Assistants—

M. G. Cameron, D.L.S.
E. Lamert.

Leveller—

S. S. Christie.

Party—

20 employees.

This district is traversed from south to north by Athabaska river, which is navigable throughout except for some rapids above McMurray which have to be portaged.

Although the land is good for agriculture the chief assets of the district consist of oil and gas, wells for which have been drilled with varying success in many places. The area of the tar sands which indicate the presence of gas and oil is unknown but development and prospecting are proceeding rapidly since the construction of the Alberta and Great Waterways railway.

Along the base line west of the Athabaska the country is very wet. Some of the land might be fit for agriculture when drained but a large portion is liable to become flooded. East of the Athabaska to the Fourth meridian the land is all sandy and wooded with a light growth of jack pine. Little or no grass grows, as a thick coat of pine needles covers the surface.

REGULAR SUBDIVISION SURVEYS.

Parties Nos. 1 and 2—Subdivision around Sturgeon Bay, Lake Winnipeg.

The district covered by these surveys is flat and swampy, and transport had to be carried on by man-packing and canoes. The swamps are separated by low ridges, the soil of which is sandy clay with many boulders and rocks. In the swamps the moss retards drainage

PERSONNEL:

J. W. Pierce, D.L.S., and
J. E. Jackson, D.L.S., in charge.

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Assistants—

J. K. Benner, D.L.S.
 F. H. Wrong, D.L.S.
 L. A. Kinnear, D.L.S.
 J. P. Howe.

Levellers—

S. F. Vineberg.
 W. F. Asling.

Party—

20 employees each.

but the subsoil is good and with good drainage the district would be fairly suitable for agriculture. The slope as shown by the levels is sufficient for this purpose but drainage on a large scale alone would accomplish any good results. The moss prevents the thawing out of the muskegs so that summer frosts are common. Along Warpath river and lake Winnipeg, however, the land is fairly well drained by natural drainage, and in places well wooded with merchantable timber up to fourteen inches. Some fine hay meadows lie in the open places and a heavy growth of tall grass is found where the timber has been killed by fire.

Party No. 3—Subdivision North of Prince Albert.

The townships surveyed lie around Clearsand lake, a body of water about four square miles in area but not over seven feet deep.

PERSONNEL:

W. Christie, D.L.S., in charge.

Assistants—

A. O. Gorman, D.L.S.
 A. Fawcett, D.L.S.

Leveller—

E. S. Kesley.

Party—

20 employees.

The area is rolling and consists of ridges and muskegs. The muskegs, however, are shallow and the subsoil is clay. Draining is comparatively easy as the slope is ample and the drained muskegs would produce an abundance of hay, which at present is rather scarce. Summer frosts are seldom severe enough to seriously damage crops.

Party No. 4—Subdivision South of McMurray.

This area is easily reached by the Alberta and Great Waterways railway. The land surveyed is all covered with bush except in the southeasterly part, where open patches with light scrub would furnish good ranching districts.

PERSONNEL:

R. H. Knight, D.L.S., in charge.

Assistants—

G. A. Tipper, D.L.S.
 L. E. Harris.

Leveller—

C. W. Graham.

Party—

20 employees.

The timber is small and of no commercial value, being only six to ten inches in diameter, and the area it covers is not large enough to be set aside as a forest reserve.

The surface is nearly level or gently rolling and muskegs and swamps are numerous. If the watercourses were opened and cleared the land would drain itself, as the slope is sufficient. The

six or ten inches of moss would then rot and a rich black loam would result, making this area one of the best for agriculture. The banks of the Christina show that the river has cut through the tar sand, to a depth of over forty feet. From the extensive areas of tar sand in this district it is estimated that about twenty cubic miles of oil have escaped from these Devonian rocks.

Party No. 5—Subdivision South of Lesser Slave Lake.

Mr. McEwen's party subdivided some townships lying between the valleys of Freeman and Athabaska rivers. This area is drained principally by Christmas creek and its tributaries; the creek is thirty-five feet wide and from two to three feet deep. The surface is gently rolling, and is covered with poplar, spruce, and tamarack of small size, with jack

PERSONNEL:

D. F. McEwen, D.L.S., in charge.

Assistants—

W. E. Robinson, D.L.S.
 P. A. Shaver, D.L.S.

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Leveller—

E. B. Purdy.

Party—

20 employees.

excellent for ranching or mixed farming.

pine on the knolls and ridges and willow along creeks and on the damp flats. The soil is good clay loam with clay subsoil, except on the sandy ridges. A luxuriant growth of grass is produced with abundant rainfall, making the district

Party No. 6—Subdivision along Notikewin River, Alta.

The subdivision on Notikewin river done by this party consisted of the complete subdivision of four townships and five more

PERSONNEL:

J. A. Buchanan, D.L.S., in charge.

Assistants—

T. H. Bartley, D.L.S.

E. F. Gorman, D.L.S.

Leveller—

H. W. Featherstone.

Party—

20 employees.

partly subdivided. The surface of this area is mostly wooded, but a large part of open prairie was found, on which several squatters had located. On these prairie spots the soil is good and grass grows luxuriantly. Prairie fires swept the whole district at the time of survey, the smoke from which was so dense that it was difficult to travel from one tent to another. Some prairie grass which the party fireguarded served as horse feed for the remainder of the work in that locality.

Parties Nos. 7 and 8—Subdivision East of Grande Prairie, Alta.

These two parties subdivided lands east of Grande Prairie consisting of ten whole

PERSONNEL:

J. H. Johnston, D.L.S., and
A. Lighthall, D.L.S., in charge.*Assistants—*

J. H. Smith, D.L.S.

J. E. Fredette, D.L.S.

K. N. Crowther, D.L.S.

B. Haggarty

Levellers—

O. B. Holmes.

W. H. Dowling.

Party—

20 employees each.

townships and five partial townships adjoining the Sixth Meridian or lying close to it. In the northern part the surface is wooded with poplar, spruce, jack pine and birch, except that part south from the Birch hills, which is more open, having been burned over several times. Birch hills are about 150 feet high, running east and west with a long, gradual slope to the south but an abrupt drop to the north. Farther south along Simonette river the area is largely prairie, only about three sections of merchantable timber being seen. All the streams have deep ravine-like valleys, across which travel is difficult, thus retarding

settlement. These ravines afford good grass and shelter for cattle, however, which render the district admirable for ranching. Smoky river, the largest stream, can be forded in a few places late in the fall at low-water, but at high-water the stream rises ten feet. Most of the small streams dry up late in the fall, and the water problem during dry seasons and winter is a difficult one, as even wells are not reliable. Hay sloughs are in demand, as many settlers raise beef cattle, and feeding them through the winter is the most difficult problem for the rancher. Eight grain elevators were built along the railway last year in the Grande Prairie district, and a rancher north-east of Grande Prairie on Smoky river had more than 300 head of cattle, and seemed to be doing a thriving business.

The greatest obstacle to successful farming in this district is the danger from early and late frosts. Some years, crops are a total failure on this account, and mixed farming is becoming general.

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Parties Nos. 9 and 10—Subdivision in Peace River Block.

The opening up of the Peace River district by the Edmonton Dunvegan and British Columbia railway has turned settlement in that direction; accordingly these two parties subdivided portions of fifteen townships in the Peace River Block, where land fit for settlement was found. Subdivision was carried on south of Pouce Coupe and in Montagneuse prairie about fifteen miles north of Fort St. John. The surface conditions in both areas are similar, the land being covered with small second growth or made into prairie patches by repeated fires. The soil is black loam on clay subsoil and is suitable for mixed farming. The streams develop deep precipitous valleys sometimes 800 feet deep and almost perpendicular in the sandstone areas. In the clay districts slides occur along the banks and crossing streams is difficult, and even dangerous at flood seasons on account of the heavy grades.

PERSONNEL:

S. D. Fawcett, D.L.S., and
L. Brenot, D.L.S., in charge.

Assistants—

C. S. Macdonald, D.L.S.
R. Bruynseraede, D.L.S.
W. E. Lumb, D.L.S.
R. P. Burchnall.

Levellers—

N. C. MacKinnon.
L. F. Brimer.

Party—

20 employees each.

In tp. 85-20-6, a number of springs were found which do not freeze in winter and a kind of grass grows around these which stays green in the fall when other grasses dry up. The Indians leave their horses in this area to rustle all winter and although not in the best of condition in the spring they look fairly well.

Fires have repeatedly overrun this whole area and the windfall is too thick to make it a good ranching district.

The climate is severe in winter and summer frosts damage crops considerably. During the last three years two good crops were obtained and it is estimated that in the summer of 1917 three hundred thousand bushels of wheat and oats were threshed in the Pouce Coupe prairie.

The rainfall is not regular though it is excessive during some years. Wells have to be sunk to a great depth and the water is frequently alkaline. Near the permanent streams however, a supply is easily obtained.

MISCELLANEOUS SUBDIVISION.

It frequently happens that subdivision is required of isolated small areas which do not warrant the expense of a regular subdivision party, and yet are too large for a travelling party. Such surveys are done by a small party, the size of which depends on the amount of work to be done.

Party No. 1—Subdivision Along Carrot River.

This party made subdivision surveys along Carrot river to provide for settlement in that area due to the mining activities.

PERSONNEL:

J. S. Galletly, D.L.S., in charge.

Assistant—

K. F. McCusker, D.L.S.

Party—

11 employees.

A strip of fairly good land lies along the river, but generally the country is low and liable to flooding. Good spruce timber is plentiful and lumbering is an important industry. Some land was subdivided also at Sturgeon Landing. This place is at the head of navigation from The Pas and all parties going to the mines at Schist and Athapapuskow lakes or the north country call there. The land subdivided is high and dry and

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covered with a thick growth of brush. The soil is clay or clay loam with a few boulders, and most of it is first-class for farming, the best quarter-sections lying along Sturgeon-Weir and Goose rivers.

More than 8,000 tons of copper ore, valued at about one million dollars, was hauled to Sturgeon Landing from the mine on Schist lake. This ore is to be taken by boat to The Pas and then by rail to Trail, B.C., for smelting. The amount of ore in sight at Athapapuskow lake is said to be near 300 million tons, and new copper ore deposits have been discovered at Cranberry lake and along Pine Root river.

Party No. 2—Subdivision in Eastern Manitoba.

The first work done by this party was at Bull Head in tp. 30-6-E., where a

PERSONNEL:

W. J. Deans, D.L.S., in charge.

Assistant—

J. H. Patterson.

Party—

5 employees.

settler had made improvements to a lot for a number of years and had applied for a patent. The portion of the lot not under cultivation or pasture is covered with willow, birch, spruce and poplar up to eight inches in diameter. The lowest part of the lot is eight feet above the water of lake Winnipeg, the land gradually rising to

twenty-five feet. The settler is engaged in cattle raising, fishing, and farming.

The remainder of the season was spent surveying the dried-up beds of Shoal and Whitewater lakes. When the original survey of the townships around Shoal lake was made the water extended right up to the bush. Now these dried-up portions are covered with grass and sow-thistle on which cattle seem to thrive. All around the lake large herds of cattle pasture all summer and do well. Large quantities of hay are also cut on this land. The soil in the dried-up area is of good quality and free from stones, and where cultivated yields good crops.

At the time of the survey of the townships around Whitewater lake, the lake had an area of twenty-six square miles and a maximum depth of ten feet. At present the lake covers seven square miles and is two feet deep. The streams which formerly emptied into the lake are now dry and it is only a question of time till the lake will disappear entirely. The soil of the dried-up area is a rich black loam mixed with sand, but the great drawback to cultivation is that it is covered with noxious weeds.

RETRACEMENT OF BLOCK OUTLINES.

Good progress has been made in retracing the old meridians and base lines; their lengths and directions have now been determined with great accuracy.

Retracement of Second Base Line west of the Fourth Meridian, and traverse of the C. P. R. right of way.

This party retraced the 2nd base across ranges 1 to 14, west of the Fourth meridian. A line of levels was also carried on along

PERSONNEL:

R. B. McKay, D.L.S., in charge.

Assistants—

T. A. McElhanney, D.L.S.
A. G. Stuart, D.L.S.

Leveller—

M. Resnik.

Party—

6 employees.

with the retracement. No monuments were established on this work as the line traversed lands which were mostly patented, the object of the survey being to determine the correct bearing and chainage of the monuments as they exist on the ground.

This work was discontinued on August 15 in order to complete the traverse along the C.P.R. from Morley to Ottertail in the railway belt.

Owing to the mountainous nature of the country in the belt and along the eastern slope of the Rocky mountains, it is impracticable to establish the initial meridians and base lines in the regular way. Instead,

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the subdivision surveys in the railway belt and along the Canadian Pacific railway from Morley westerly have been established by means of traverses along the right of way of the railway. Reference marks were established along the right of way and from these points the subdivision surveys were projected. These reference marks or hubs are known as the Canadian Pacific traverse hubs and are described as C.P.T.'s

East of the summit of the Rocky mountains no C.P.T.'s, were planted but a traverse was made along the right of way, and a number of section and quarter-section corners established

These corners were checked by a triangulation extending from the vicinity of Calgary, Alta., to Salmon Arm, B.C. The triangulation indicated the existence of discrepancies in the position of the corners; another traverse was accordingly made to determine the exact position of the corners.

Morley was chosen as the starting point since it was quite near the triangulation station of Chiniki. The traverse was very carefully made, all courses being chained twice with two different tapes which were frequently compared with the standard. The angles were measured with a base line transit which read to seconds.

As the traverse was extended westerly ties were made to the adjoining section or quarter-section corners frequently enough to determine their precise location.

RESURVEYS.

The early township surveys were not so elaborate and were not made with the same care as at present. Land had little value and the cheapest method of survey was considered good enough. The monuments often consisted of nothing more than a small poplar post, which disappeared after the first prairie fire. Later small iron posts were used; they were more permanent, if not interfered with, but many were pulled up by travellers and used for pegs, crowbars, and other purposes. In other cases, they were wilfully and systematically removed by evil-disposed persons. Under such conditions, the settlers have difficulty in locating their lines and they ask for resurveys.

Where the amount of work to be done in a township is small and does not warrant the expense of a regular party, the survey is made by a travelling party consisting of a surveyor and his assistant.

Frequently the subdivision lines have to be extended over the dried-up bed of a lake.

Sometimes settlers locate on unsurveyed lands in remote parts of the country. After making improvements they apply for a patent, and in order that their request may be granted some sort of survey is necessary. If near any boundary monument of the Dominion Lands system, the settlement is surveyed and tied in to the monument, but if no monument is near, the connection is made when the Dominion system is extended to that locality.

Party No. 1—Resurveys North of Swift Current.

The resurvey of a block of seven townships about forty miles north of Swift Current constituted the work of this party. Most of

PERSONNEL:

J. M. Cote, D.L.S., in charge.

Assistants—

L. A. VanSkiver, D.L.S.
A. M. Mills.

Leveller—

D. Gourley.

Party—

11 employees.

this area is at present held under grazing leases and lies in the valley of South Saskatchewan river. The valley is from three to seven miles wide and from four to six hundred feet deep. The greater part of this area is fit for agricultural purposes as the soil is a rich clay loam. A number of springs give a permanent supply of slightly alkaline water. Summer frosts are unknown.

In addition to the resurvey work, this party traversed Connell and Harehill creeks which form the westerly boundary of the Pasquia forest reserve.

SESSIONAL PAPER No. 25a

Party No. 2—Resurveys in Northern Alberta.

This party was employed on correction work in northern Alberta and also on inspection of Contract No. 17 of 1914 west of McMurray. A subdivision survey executed under contract in the Peace river valley had been left unfinished and Mr. Fontaine's party was detailed to complete it and to correct the deficiencies.

PERSONNEL:

L. E. Fontaine, D.L.S., in charge.

Party—

6 employees.

The contractor had been asked to correct these deficiencies but refused to do so. Accordingly a deduction was made from the amount of his contract to cover the cost of correction.

Many of the posts were improperly planted and had to be reset. Other posts were driven into the ground with a mallet and the flanges broken off. The pits were not all of regulation size; where too small, they were made larger. Lost corners were re-established and at quarter-section corners falling in sloughs which were marked by long wooden posts, witness monuments were erected.

Parties Nos. 3 to 6—Travelling Parties.

Each of these surveyors with one assistant constituted a "travelling party." The work done by these parties in most cases was of small extent and scattered over so extensive a territory that the expense of a fully organized party was not warranted; local help was hired when necessary. The work included retracement surveys for the purpose of obtaining correct bearing and chainage of old lines; restoring old obliterated monuments; resurveying bodies of water which had changed in area since the original survey, and generally, doing any small amount of survey work in any locality.

PERSONNEL:

S. L. Evans, D.L.S.

A. E. Glover, D.L.S.

E. S. Martindale, D.L.S., and

R. C. Purser, D.L.S., in charge.

Assistants—

O. B. Roberts, D.L.S.

W. P. Daly, D.L.S.

G. S. Bayly.

H. W. Churchill.

In addition to the regular survey work they took observations for magnetic declination, magnetic inclination and total magnetic force when this work could be done without materially affecting the progress of the regular work.

RAILWAY BELT SURVEYS.

The "Railway Belt" comprises a strip of land extending twenty-four miles on each side of the main line of the Canadian Pacific railway across the Province of British Columbia.

The land within the belt is very rough and mountainous although some level bottom lands are found, and bench lands are frequent. As surveyors cannot be advised beforehand of the lands to be subdivided they have to use their discretion in deciding whether or not land is suitable for subdivision.

The equipment of a party in the "Belt" is larger on account of the variety of conditions met with in short distances. In a mile of line a surveyor may have some prairie, heavy woods, almost inaccessible cliffs, and snow-clad summits to contend with and must arrange his transport accordingly. Corner monuments often have to be located by traverses and the whole work requires to be carefully done on account of the rough nature of the district.

As no separate parties are provided for base line, subdivision, stadia, or resurvey work in the belt, the regular surveyors are required to perform all the kinds of survey work necessary in the area covered by their instructions.

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Party No. 1—Surveys South of Revelstoke, B.C.

In some of the townships within Mr. Stewart's district areas of bottom lands were originally heavily timbered and as all the timber was cut off only a tangled mass of wreckage was left with stumps up to ten feet in diameter. The soil, however, is excellent and when cleared will produce abundantly, while the bench lands farther up the sides of the mountains furnish excellent grazing. Lumbering and mining camps are numerous and prospectors are staking new claims wherever minerals are likely to be found. The beds of the streams are said to contain gold, platinum, antimony, silver, and copper. Good fir timber grows and cedar fence posts are shipped to the prairie provinces in large quantities.

PERSONNEL:

N. C. Stewart, D.L.S., in charge.

Assistants—

J. W. Doze, D.L.S.

W. Humphreys.

Party—

7 employees.

Party No. 2—Surveys near Chase, B.C.

A large portion of the work of this party was the establishment of the boundaries of forest reserves. These reserves lie entirely on the mountain sides and although they do not include any agricultural land some very good areas of pine grass are found which furnish good grazing. In the bottom land the soil is a sandy loam and is very productive, but most of the land requires irrigation. The timber as a rule is small and no minerals are found. The only drawback to making this a good dairying district is its distance from a suitable market.

PERSONNEL:

W. J. Johnston, D.L.S., in charge.

Assistants—

J. A. Carson, D.L.S.

J. C. Tassie, D.L.S.

Party—

7 employees.

Party No. 3—Surveys North of Kamloops, B.C.

An area of good agricultural land lies along North and South Thompson rivers near the north boundary of Kamloops Indian reserve, and Mr. Taggart's party re-traced this boundary, which was run thirty-nine years ago, in order to determine how much land lies within the reserve. Of the 2,000 acres of agricultural land within the reserve only about 500 acres are under cultivation. Irrigation is necessary but water for that purpose is convenient and the supply sufficient. The boundaries of Monte Hills forest reserve were also run to ascertain whether some agricultural land in tp. 16-14-6 was within the reserve. Most of this agricultural land is already taken up but some good range land still remains.

PERSONNEL:

C. H. Taggart, D.L.S., in charge.

Assistant—

C. J. Higgins, D.L.S.

Party—

7 employees.

Party No. 4—Surveys West of Ashcroft, B.C.

The lands subdivided by Mr. Calder's party lie along Bonaparte river; the boundaries of Hat creek forest reserve and Bonaparte Indian reserve were also retraced. In the valley of Hat creek extensive bench lands are found at high elevations but in most cases irrigation would be necessary and water for this purpose is lacking. The prevalence of summer frosts is also a drawback to successful farming at high elevation. Grass grows abundantly, however, and stock raising and dairying could be carried on successfully. Clearing the ground is very expensive, as huge stumps and fallen trees are numerous, but when cleared the soil is fertile.

PERSONNEL:

J. A. Calder, D.L.S., in charge.

Assistants—

Jas. Gibbon, D.L.S.

J. B. Walcot.

Party—

7 employees.

SESSIONAL PAPER No. 25a

STADIA SURVEYS.

When the townships in the western provinces were originally subdivided many bodies of water existed which have now wholly or partially dried up. In other cases bodies of water are found not shown by the original survey, either because they were not noticed or were not large enough to be surveyed.

During a wet cycle of years lakes may also appear where none existed before. The areas given on the township plans can no longer in such cases be accepted as correct. Stadia surveys, so called from the particular method of survey used, are made for determining the present area and permanency of all bodies of water. A district is assigned to each surveyor and he is expected to investigate and report on all bodies of water over five acres in extent in each township in which he operates. If a body of water is over five feet deep or if it does not dry up in the fall the banks are traversed. Rivers over one chain wide and all islands are accurately surveyed. The surveyor also reports upon the condition of the boundary monuments in the township and he may restore a few of them if lost, but as his party is small, work of this nature is generally allotted to larger parties.

Party No. 1—Surveys West of Moosomin.

The area included in the investigations of this party comprised about sixty townships west of Moosomin. The district is well

PERSONNEL:

C. Rinfret, D.L.S., in charge.

Assistant—

T. Melrose, D.L.S.

Party—

3 employees.

served by railways and all the land is patented but some good homesteads are held by speculators. The roads are well graded and automobile travel is possible everywhere.

The main industry is mixed farming and drouth does not seem to affect crops in a dry

year as it does in other areas. The sloughs and lakes contain fresh water except four or five which are alkaline. Many of the former lakes and sloughs are now dry and producing good hay. South of Indian Head is the Government Nursery, from which trees for planting are furnished to the settlers at nominal prices.

Party No. 2—Surveys around Quill Lakes, Sask.

The nearest town to the area investigated by Mr. Walker was Humboldt, in tp. 37-23-2, where the party was organized. In

PERSONNEL:

C. M. Walker, D.L.S., in charge.

Assistant—

C. H. Snell.

Party—

3 employees.

general the district is not very well settled except in the southwest part and a few of the roads are graded. The soil is light and inclined to be stony, and the surface is covered with light scrub where it has not been broken. The surface is rolling with plenty of water for stock and

numerous bluffs for shelter, making the district favourable for mixed farming or cattle raising.

Party No. 3—Surveys East of Prince Albert, Sask.

The district east of Prince Albert was examined by this survey party. Monuments were established where the work was not

PERSONNEL:

P. M. H. LeBlanc, D.L.S., in charge.

Assistant—

J. G. Wright, D.L.S.

Party—

3 employees.

extensive in the dried-up beds of lakes and a few section lines retraced. A large number of lakes, originally called marshes, were found, and around Jumping lake the land has been encroached on to a considerable extent. Carrot river, a portion of which was traversed, is very winding and its course is about the same as in the original survey.

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The surface is rolling and partly timbered and although most of the area is patented much of the land is held by speculators and therefore not much improved. Hay can be obtained from the marshes surrounding the lakes, which is of great benefit to the settlers, most of whom are engaged in mixed farming.

Party No. 4.—Surveys North of Saskatoon, Sask.

The work of this party was confined to a group of about fifty townships lying

PERSONNEL:

P. J. McGarry, D.L.S., in charge.

Assistant—

R. C. Manning.

Party—

3 employees.

immediately northeast of Saskatoon. The character of this district is fairly uniform, being nearly level or gently rolling prairie. Practically every quarter-section is under cultivation, and the farmers are engaged almost exclusively in growing wheat. This district is settled mostly by Mennonites who live in small villages and go

out daily to their farms, sometimes a distance of five or six miles. This method of working has its advantages and disadvantages. The main advantage is that the people have their homes close together and at a very short distance from their schools, churches, and other places of meeting. Their home life is made more congenial, but the great drawback is the fact that a large portion of the farmer's time is spent going to and coming from his fields. The people appear to be getting tired of this kind of living and there seems to be a tendency, particularly among the younger generation, to abandon the village life and erect their homes close to their work.

Portions of both North and South Saskatchewan rivers were traversed. Each river is from twelve to twenty chains wide and from five to twenty feet deep. Both flow about five miles per hour and the water level is over one hundred feet below the level of the surrounding country. The banks are usually steep and thickly wooded.

Party No. 5.—Surveys South of Swift Current, Sask.

The area where the surveys of this party were located extends from township 1

PERSONNEL:

G. C. Cowper, D.L.S., in charge.

Assistant—

E. L. Morehouse.

Party—

3 employees.

to township 10 across ranges 1 to 24 west of the Third meridian. All the townships are well settled and considerable improvement has been done on the roads. No railroad crosses this area and settlers have to haul their grain from thirty to sixty miles before reaching a station.

No large water areas were found but many shallow depressions having no outlet are filled with water during wet years. In dry years they become valuable hay meadows. Many of these sloughs could be drained and made to yield an assured crop of hay each year. Frenchman river drains a considerable part of southern Saskatchewan. It rises in Cypress lake, in tp. 6-26-3, and flows southeasterly, eventually joining Milk river in Montana. Its width varies from sixty links to two chains, and the valley varies from one to two miles in width and 100 to 350 feet in depth. The stream is very winding as its length is 216 miles in going 62 miles east and 31 miles south. The valley flat is mostly gumbo and is not very productive except where irrigated.

Party No. 6.—Surveys Northwest of Swift Current.

The district covered by the surveys of this party has been settled for ten or twelve

PERSONNEL:

G. A. Bennett, D.L.S., in charge.

years and the farmers have fine buildings and well tilled farms. At the westerly side the surface is hilly and is best suited for grazing. Lakes

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Assistant—
J. E. Gray, D.L.S.

Party—
3 employees.

which existed at the time of the original survey thirty years ago are now dry and producing good hay, or are valuable pasture. The soil is heavy clay loam, well suited for wheat growing.

A stadia traverse of South Saskatchewan river was made from the Fourth meridian easterly to tp. 23-20-3. A comparison of this traverse with the old survey made over thirty years ago showed large changes in the course of the river. Large islands have disappeared and former sandbars are now islands, grown up with willow and poplar. In many places the banks have been eroded to a depth of more than ten chains, while in others many areas of new land have been built up which are now covered with dense willow and poplar.

Party No. 7.—Surveys West of Battleford.

Operations in the district investigated by this party were begun in tp. 44-21-3 in

PERSONNEL:

J. A. S. King, D.L.S., in charge.

Assistant—
A. S. Campbell, D.L.S.

Party—
3 employees.

which Cutknife hill is located, the scene of one of the battles of the Northwest Rebellion of 1885. This hill is the highest point in the vicinity. Nearly all the lakes are salty or alkaline and are drying up owing to the extensive draining operations being done and to climatic conditions. South and west from Battleford the lakes are

shallow and so alkaline that the water is fit only for stock. Farther north however the lakes are salty and bitter holding clear deep sparkling water. Residents say that the water in these lakes is identical with that of Little Manito lake at Watrous which is famed as being of medicinal value. The water in Sherlock lake in tp. 44-28-3 seems to be a supersaturated solution, as immense quantities of crystalline material are deposited along the shore and on the bottom to a depth of three or four inches. The water tastes exactly like Epsom Salts. Practically the whole area has been settled during the last ten years, but it appears like an old settled district as the farms are well tilled, have good buildings, and everything appears up-to-date. Wheat growing is the main occupation but cattle raising is an important industry, on account of the vacant land furnishing good pasture.

Party No. 8.—Surveys West of Lloydminster.

Investigations were begun by this party in the south part of the district as in the

PERSONNEL:

T. A. Davies, D.L.S., in charge.

Assistant—
A. H. King.

Party—
3 employees.

north part the valley of Vermilion river was flooded to a depth of from one to three feet until later in the season. Travelling through the Vermilion district is easy as there are many graded roads and frequent bridges with graded approaches on both valley slopes. Besides the traverse of all lakes within this area Vermilion river

was traversed across ranges 9 to 5 in township 51 and Battle river from range 9 easterly to the Fourth meridian. The district along Battle river is well settled and produces good crops of grain. Mixed farming is followed throughout the district, the settlers raising cattle and hogs. The Edmonton City Dairy Co., have established agencies in most of the towns along the Canadian Northern railway. These agencies conduct a thriving business in dairy products with the farmers of the district.

Party No. 9.—Surveys North of Macleod.

The district between Macleod and Lethbridge was investigated by this party as far

PERSONNEL:

W. J. Boulton, D.L.S., in charge.

north as Little Bow river, and this river was traversed across ranges 22 to 25. The course of the river has changed but little since the original

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Assistant—
W. A. Spence, D.L.S.

Party—
3 employees.

Belly rivers were also partly traversed. A number of changes have taken place in the course of these rivers, many curves being cut off altogether and numerous slides having taken place. Highwood river runs through a regular sandstone and gravel gorge. Considerable spruce was found along the banks. During the traverse of Bow river it was found that many of the former islands have been washed away and many new islands formed. The irrigation canals from the river make the district suitable for farming.

survey. A few nice flats which are at present used for grazing are available for cultivation. The river proves a valuable asset to the farmers as it furnishes water for stock. Oldman and

Party No. 10.—Surveys Northeast of Red Deer.

The townships lying around Buffalo lake north of a line between Red Deer and

PERSONNEL:

W. H. Norrish, D.L.S., in charge.

Assistant—
D. E. Chartrand, D.L.S.

Party—
3 employees.

Stettler were examined by this party. The surface is in general rolling, but a great deal is covered with scrubby poplar and willow. The soil is a rich dark loam with a good clay subsoil, producing a luxuriant growth of grass and also good crops. The farmers are mostly engaged in mixed farming. A great amount of

hay is cut annually around the sloughs but of late years this is growing less as the water in the sloughs appears to be rising. A number of the small lakes could be easily drained as the slope is sufficient. Cygnet lake in tp. 38-1-5 is a large slough with very little open water. The Canadian Pacific railroad is graded across the centre of the lake. Some years ago the railway company dug a ditch to drain the lake into Red Deer river with the result that the lake was considerably lowered. Since 1914 however very little change has taken place in the shore line. The outlet appears to be filling up and if it were cleaned and deepened the amount of hay land would be greatly increased.

Party No. 11.—Surveys Northeast of Edmonton.

This party examined about fifty townships northeast of Edmonton and extending

PERSONNEL:

H. M. R. Soars, D.L.S., in charge.

Assistant—
E. Nelson.

Party—
3 employees.

westerly to the Fifth meridian. The surface is rolling or undulating with many poplar or willow bluffs. The only land not taken up consists of some muskegs and sandhills, but a number of good homesteads held by speculators are still lying idle. Around Morinville and Rivière-Qui-Barre, the land is poorly drained and has some

low gumbo flats. Seeding here was delayed till June. Although hay is scarce, the dairying industry is active. Coal is mined near Morinville and Cardiff. Saskatchewan river was traversed for about 100 miles easterly from Fort Saskatchewan. It flows in a fairly narrow valley from 60 to 125 feet in depth with wooded steep banks or bare cut banks. The river bed is generally stony with many gravel and mud bars. The main channel has an average depth of nine feet. A small paddle-wheel steamer plies between Edmonton and the various points on the river as far east as Wasel in tp. 58-15-4. This is a great benefit to the farmers as the steamer carries grain and produce to the Edmonton market and saves the long hauls to a railway.

SESSIONAL PAPER No. 25a

TOPOGRAPHICAL SURVEY OF BOW RIVER FOREST RESERVE.

The lands within forest reserves not being available for homesteading, the survey of Dominion Lands is not extended into the reserves. For the proper administration of the forests, a good topographical map and some permanent reference points are necessary, and as this map and the points are not furnished by the regular township surveys, a special survey had to be undertaken for the purpose.

PERSONNEL:

M. P. Bridgland, D.L.S., in charge.
Party—
 7 employees.

After consultation with the Forestry Branch a photo-topographical survey combined with traverse lines was decided upon as best meeting the requirements; the work was begun in the Bow River reserve. Traverse lines were run throughout this reserve and levels taken, and permanent monuments were established at suitable intervals. A photographic survey was also made, the necessary triangulation being based on the traverse. In all fifty-seven photographic stations were occupied. Some difficulty was experienced in obtaining suitable photographic stations, most of the hills being heavily timbered. Frequently stations could not be had where they were most needed. The reserve is in the foot-hill region, with rolling hills 5,000 to 6,000 feet above sea-level, or about 500 to 1,500 feet above the lower valleys.

INSPECTION OF SURVEYS.

Until the year 1914 subdivision of Dominion lands was performed under contract. The contractor was paid so much per mile and furnished all the party and supplied the men, equipment and provisions necessary for the survey. All work was inspected and deductions were made for deficiencies unless corrected by the contractor. The inspection of a contract involved considerable work; five inspectors were necessary.

PERSONNEL:

A. M. Narraway, D.L.S., Controller of Surveys.
 G. J. Lonergan, D.L.S., Inspector of Surveys.

When subdivision by contract was abandoned in 1915, the mode of survey inspection had to be changed. Instead of checking the work executed and seeing that the terms of the contract were complied with, the equipment of the survey parties, the efficiency of their management and the supervision of their work are the points requiring attention. For this purpose, a Controller and an Inspector are sufficient. They visit all the parties, examine carefully the equipment, the management of the party, the food supplied, the men engaged by the surveyor, the methods of survey, etc. They assist in the organization of the parties, the purchase and distribution of outfits, the wintering of horses, storing and disposal of outfits, etc.

In general the Controller visited the parties working on base lines and subdivision, while the Inspector visited the stadia parties and those on miscellaneous surveys.

LEVELLING.

The lines of levels are of four kinds, precise levels run along railway lines, levels run along travelled highways, levels run along meridians and base lines at the time of original survey, and township subdivision levels.

PERSONNEL:

J. N. Wallace, D.L.S., Director of Levelling.

Assistants.

J. B. Alexander, D.L.S.
 L. O. R. Dozois, D.L.S.

Party—

12 employees.

On precise level lines the limit of error is 0.015 feet in a mile, lines being run both forward and backward. If the limit of error is exceeded the mile is relevelled. These precise levels are the control lines for all other level lines, and are connected to a mean sea-level

datum. This connection in turn connects up all the other level lines run by this branch in Canada and thus places all the levels on the sea-level datum.

The second class of levels, run along travelled roads or other routes where no railway lines are available, have a limit of error of 0.030 feet per mile. These lines act both as an intermediate control between the lines of precise levels and other lines less accurate than themselves, and also record all local elevations needed for general information along their course.

Levels run along meridians and base lines were the first levels inaugurated and at present form most of the levels run. The limit of error is 0.10 feet in a mile. These early base line levels were not connected and there was no means of comparing the elevations of one line with those of another. The running of the precise and secondary levels serves to connect these base lines and to place them on sea-level datum. Where precise levels have been run across these base lines it has been found that the base line levels are not sufficiently accurate, long lines of levels run under the exigencies of original survey being liable to a greater accumulation of error than the average leveller can be brought to realize. These connections show the need for more precise and secondary level lines.

Subdivision levels are run so as to form closed circuits the closing error averaging less than half a foot in an eight-mile circuit. Sufficient information is secured from these levels to place contour lines on the township plan, the positions of the contours being accurate where they cross levelled lines, while the connection of each contour from line to line is sketched in.

Only one party was employed on precise levelling last season and there was also a decrease in the mileage of meridian and base line levels, and of subdivision levels due to the curtailment of survey work.

The following table shows the miles of levels run during the year, and the total mileage at the end of the year:—

	Season of 1917.	Total.
Precise levels..	331	3,139
Secondary levels..	323	998
Meridian and base line levels..	498	11,887
Subdivision levels..	2,335	6,693
Other lines of levels..	321
Total..	3,487	23,038

ALBERTA AND BRITISH COLUMBIA BOUNDARY.

In 1917 work was commenced on the second section of the British Columbia and

PERSONNEL:

R. W. Cautley, D.L.S., Com-
missioner for Canada and Alberta.
A. O. Wheeler, D.L.S., Com-
missioner for British Columbia.

Assistants—

A. J. Campbell, D.L.S.
T. R. Brown.

Party—

11 employees.

Alberta boundary survey, viz: between the main lines of the Grand Trunk Pacific and the Canadian Pacific railways. The methods, distribution of the work, and composition of the parties were similar to those of the preceding years. Mr. R. W. Cautley representing the Dominion and Alberta Governments was in charge of the survey of the watershed across the passes where concrete monuments were built and Mr. A. O. Wheeler, representing the

British Columbia Government was in charge of the photo-topographical survey of the watershed between the passes and of the placing of brass bolts and cairns at points above timberline and at points where concrete monuments could not be built. The first work done was at Howse pass about thirty miles northwest from Kicking Horse pass. It is 319 feet lower than Kicking Horse pass and was the southerly main route of travel of the North West Fur Trading Company across the continental watershed. It was discovered by David Thompson in 1807 and was named after Joseph Howse who was the first Hudson Bay trader to establish a post west of the Rockies.

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The boundary was also marked through Yellowhead pass which is at present the lowest railway pass across the continental divide. This pass was used by the Shuswap Indians in their journey from Kamloops to Jasper House where they traded with the fur companies. It was also used by voyageurs in going from the headwaters of the Athabaska to those of the Fraser, but was abandoned on account of the difficulty of navigating the latter river. The pass was named after an Indian named "Tete Jaune" who seems to have been a man of some distinction in the neighbourhood.

Since the construction of the railroad the trails leading through the pass have fallen into disuse and are difficult to travel on account of windfall and washouts. Splendid timothy hay grows along the old tote roads and berries of almost all kinds are to be had in great abundance on both sides of the summit.

TIMBER BERTHS AND MINERAL CLAIMS.

Two timber berths were surveyed and portions of two others comprising in all twenty-one and a half miles of boundary line.

The regulations for the disposal of quartz mining claims require that the recorded owner of a mineral claim shall have a survey thereof made at his own expense by a duly qualified Dominion land surveyor under instructions from the Surveyor General within one year from the date upon which he is notified to do so by the proper officer of the Department of the Interior. Eighty-six claims were surveyed, principally in Manitoba. The mineral in the Rice Lake district in the southeastern part of the province is gold-bearing quartz. Around Flinflon, Beaver, and Herb lakes, north of The Pas, rich copper ores have been located.

SETTLEMENTS AND TOWNSITES.

This work was very limited. Small settlements were surveyed at Sandilands and Sturgeon Landing in Manitoba, and at Drumheller in Alberta.

The subdivision at Sandilands in tp. 4-9-E, was made in acre lots. The settlement is situated in low level swamp lands and the district is furnishing a considerable supply of cordwood for use in Winnipeg.

Sturgeon Landing is at the head of navigation from The Pas and all parties going to the mines at Schist and Athapapuskow lakes or the north country call there.

Drumheller is a flourishing coal mining town in the valley of Red Deer river on the Canadian Northern railway about eighty-five miles northeast of Calgary. The coal mined is of a semi-bituminous variety and is used extensively throughout the West for domestic purposes. Many of the miners had squatted on the land in question and the subdivision was made in such a manner as to allot to each squatter his improvements.

PART II—OFFICE WORK.

SURVEY INSTRUCTIONS AND ACCOUNTS.

Under the direction of the Supervisor of Field Work and Accountant, the programme of survey operations was prepared and the amount of money required to carry out the proposed scheme estimated. For this purpose a record is kept of all requests for surveys. The trend of settlement as indicated by homestead entries, the staking of mineral claims, the disposal of timber limits, etc., are also taken into consideration.

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The instructions to surveyors, describing the surveys which they were to make, were drafted by this division. Stock accounts are kept of the equipment available, which is distributed among the parties.

The surveyors' accounts were checked and paid. All office expenditure was checked and paid by the accountant. He also prepared the office pay-lists and checked the attendance.

DIVISION OF SURVEYS INFORMATION.

The work of this division comprises the answering of requests for information relating to surveys; the preparation of information to accompany the instructions to the surveyors in the field; the issuing of preliminary township plans; the entering of survey returns in the various registers; the issuing of the annual report and other publications, and generally work not specially assigned to other divisions.

About 2,000 plans and sketches are required each year to accompany the instructions to the surveyors in the field.

The returns from the surveyors in the field are first received in this division. After being entered up in the various registers, they are forwarded to another division for examination.

In addition to the annual report, the "Description of and Guide to Jasper Park" was prepared and is now in the printers' hands. It is expected that it will be issued in time for the 1918 tourist season. The book will be accompanied by a map in six sheets on a scale of about one mile to an inch.

The preparation of the "Catalogue of Maps in the Collection of the Geographic Board of Canada," which was commenced last year, has now been completed. This consists of a graphical index in twelve sheets and a list of the maps in the collection of the board, giving for each map the title, scale, size, name of publisher and date of publication. The index sheets have already been printed and the list of maps is ready for the printer.

DIVISION OF EXAMINATION OF RETURNS OF SURVEYS.

The work of this division comprises the examination of the returns of survey of all Dominion lands and the preparation of all official plans thereof. It includes the examination of all mineral claim surveys and of all plans of railways and provincial roads.

The part of the staff working on British Columbia surveys has now been brought from the Imperial building and their filing space consolidated with the furniture of the remainder of the staff in the head office.

In the early part of the year the staff is engaged upon the examination of the surveys of the preceding year. In the summer and autumn the surveyors' progress reports and the stadia surveyors' field notes and plots are received and examined to see that correct methods are being employed and satisfactory results are being obtained. Progress sketches to the number of 1,064 were examined and 8,757 miles of stadia surveys, comprising 204 field books and 1,159 plots, were examined and compiled upon township plans. As in former years, a number of stadia surveyors came into the office during the winter to assist with the preparation of the official township plans showing their work.

The township plans showing by which surveyor each monument was erected have proven their worth. This information has been placed on each of the 741 township plans and 52 miscellaneous plans compiled during the year.

Increased accuracy has been observed in the surveys performed under the new method of subdivision and recorded in the new field books specially designed for field

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use. Not only are the field notes more accurate, but information contained is much more complete and reliable. The topographical sketches now submitted by the surveyors on the new forms bid fair to become a most important source of information concerning the country being surveyed.

Our present practice of not showing the areas on our township plans for lands that have been patented has occasioned numerous requests from individuals, companies and municipalities for the areas according to the latest surveys of quarter-sections previously patented. The department having decided to furnish this information, the parties requesting it are informed how the areas would have been shown if the lands had still been Dominion lands at the date of the issue of the plan; including information furnished to other branches of the department, 247 sketches were prepared and 3,308 areas supplied.

The returns of survey of the boundary between Alberta and British Columbia for the season of 1916 were examined and the first part of the report of the Commissioners, including the operations from 1913 to 1916 inclusive, was revised and sent to the Printing Bureau for publication. It is expected that this report, together with the map atlas accompanying it, will be published during 1918.

Indexes were prepared for the albums of photographic views taken by Messrs. A. O. Wheeler, B.C.L.S., 1913-17; M. P. Bridgland, D.L.S., 1913, 1916, and 1917; and R. D. McCaw, B.C.L.S., 1913.

The compilation of group maps of the Yukon Territory was completed for practically all districts containing surveys. While surveying in the Yukon has practically ceased, there has been a marked increase in the number of mineral claim surveys in Manitoba. Returns for 166 claims outside of the Yukon were received, including 22 iron claims on the Belcher islands in Hudson bay and 14 claims in British Columbia.

The topography of 126 townships was prepared from the survey returns and furnished to the Calgary office in connection with levelling.

The number of provincial road plans has remained about the same as in former years, 540 plans having been examined, the combined mileage of which exceeded 1,000 miles.

The railway plans examined during the year also exceeded in mileage 1,000 miles. As several copies of many of the plans were submitted, the gross mileage was 2,142.

DRAFTING AND PRINTING DIVISION.

In other divisions returns of survey are examined and plans compiled. The work of the Drafting and Printing Division consists mainly in redrawing these plans for reproduction, special attention being paid to neatness, arrangement, lettering and general appearance. Type is coming more and more into use in copying, as it proves to be much quicker and gives more uniform results than hand lettering. Only in the case of the finest maps is hand lettering still employed.

Township Plans.

As in former years these constitute the great majority of the plans, 984 having been prepared for printing. Their preparation is thoroughly systematized and every means possible is used to lessen the work. Various printed forms are used showing roads, section numbers and quarter-section lines of the different systems of survey so that by adding numerical data, topography and descriptive matter the plan is soon prepared. Titles and foot-notes are printed on a small type press and attached to the plan by means of photographic dry mounting tissue.

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Plans of Subdivisions, Settlements, Townsites, and Miscellaneous Surveys.

Eighty plans of this kind were prepared. Among them was a map of the central part of Jasper Park in six sheets, scale 1: 62,500, or 1.014 inches to the mile with contour intervals of 100 feet and printed in four colours. This map of Jasper Park has also been printed on a single sheet on a reduced scale of 1:125,000 also in four colours. Sketch maps of the country adjacent to base lines run during the previous season and profiles of the lines are being prepared.

Miscellaneous Work.

One hundred and twenty-three miscellaneous jobs were done. These included a great variety of work as for example the illustrations for the preliminary and final editions of the Manual, several editions of the Astronomical Field Tables, maps to accompany orders in council, and a series of index maps for the Geographic Board. In addition 63 plans were mounted on linen for office use and 22 commissions and certificates were engrossed for the D.L.S. Board.

Storing and Distribution.

As the drafting room is convenient to the store-room, the distribution of sectional maps and other matter is undertaken by this division. The stock of sectional maps is checked monthly and a report of the stock sent to the Chief of the Sectional Map division for the purpose of reprinting before the stock runs too low. In the store-room also are kept old files of letters and papers not frequently called for, as there is not enough room to store them in the correspondence room. The giving out of these files is also undertaken by this division.

SECTIONAL MAP DIVISION.

The regular work of the office consists of:—

- (1) Compiling and drafting sectional maps.
- (2) Editing pamphlets of surveyors' reports.
- (3) Preparing sketch maps sent in by base line surveyors.

New editions of seventeen sectional maps were compiled and nine others are in hand. One new sheet, Dawson, No. 1052, covering the famous gold mining region in the Yukon Territory was compiled. The contouring of sectional maps, begun last year in the surveys office at Calgary, has been continued. When a new sheet has been compiled or an old one revised, a tracing and two prints are sent to the Calgary office. There contours are added to the tracing which is then returned, and after adjustment, the contours are added to the finished sheet. Seventeen sheets were dealt with in this way.

The township reports received from surveyors for the year from April 1, 1916, to March 31, 1917, were prepared and printed in four pamphlets containing 134 pages. The preparation of reports for the year from April 1, 1917, to March 31, 1918, is now in hand.

Two sketch maps by base line surveyors, covering 308 miles of line run and 3,500 square miles of new country explored, were examined and afterwards coloured in such a way as to show the nature of the soil and the kinds and extent of the timber.

For some time it has been felt that something should be done to prevent duplication of the names of physical features and generally to secure suitable names in the new districts being opened up. When a district has been settled and names given by the settlers have found their way into maps, it is very difficult to make changes. The

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only way is to examine names as they appear in the surveyors' returns. This work has been taken up by this office and all plans, sketches, reports, and field notes sent in by surveyors are now carefully examined for new names of features. Names that are considered suitable and are not duplicates of names already in use are accepted and the surveyor is asked to give a reason in each case why such name has been used. If the names are objectionable either in themselves or by reason of duplication the surveyor is asked to suggest others. It is hoped in this way to secure suitable names for the chief features in a district and to avoid the use of objectionable names which is sure to occur if the naming of features is left to the incoming settlers. The returns examined in this connection consisted of 40 general reports, 277 plots, plans, and sketches, and 66 field-books.

SPECIAL SURVEYS DIVISION.

Base Line Surveys.

Instructions for base line surveys were drafted and the surveys and closings checked. On base line surveys made during recent years the surveyor has no check on his work after leaving his initial point until he reaches his objective, usually from 140 to 180 miles distant. He relies solely on his azimuth observations for maintaining the proper direction of his line. Of the base line surveys made during 1917, only two lines were closed between initial meridians. One of these, 143 miles long, surveyed from the Fifth to the Fourth meridian intersected the latter meridian only twelve feet from the post which formed the objective point. The other line, 180 miles long, portions of which had been surveyed previously, was closed westward on the Second meridian, the line intersecting the meridian only thirteen feet from the objective point. Much greater accuracy has been observed in the surveys of base lines and meridians made during recent years, due to improved instruments and more careful methods. In the bearings especially greater accuracy could hardly be expected. The accurate measurement of the lines is a more difficult problem and while there has been a great improvement in this respect there is still something to be desired.

The work of checking old base lines and meridians has been continued. Until the retracements on the ground are completed, an accurate report on this work cannot be made. The examination is based on latitude observations of precision, taken with a zenith telescope, and carefully connected. The results of the observations are given in Appendix No. 4.

Astronomical Work.

Azimuth Observations.—The astronomical observations for azimuth taken on the base lines surveyed since those published in the last annual report, have been examined and the results tabulated. The field-work appears of the same high degree of accuracy as that of the immediately preceding years, and does not seem to be susceptible of much improvement under the usual survey conditions. The accuracy obtained in the astronomical work of observing for azimuth on the survey of governing lines, is much greater than that obtained in the production of the line or in its linear measurement. In other words if the length of the line could be measured as accurately or with as much surety as the azimuth is determined little would remain to be desired in the chaining.

The one factor which more than any other has interfered with accurate production of the line in azimuth has been the nature of the ground surface. A firm unyielding surface is ideal, but where a large muskeg or mossy area extends over several ranges or townships an examination of the azimuth records will certainly show larger deflections in bearing than in ordinary woodland, although the observing itself is usually done with such care that the range between observations at a station does not alter to a noticeable extent.

Astronomical Field Tables.—The four sets of tables for the position of Polaris and the table giving the right ascension and declination of the sun were computed and printed as usual. Two of the former give the azimuth of Polaris for every twentieth township while the other two give it for every second degree of latitude up to 56°. The periods covered by these tables are:—

- October 7 to December 14, 1918.
- August 15 to October 7, 1919.
- June 2 to August 16, 1920.

and

- December 14, 1918 to March 7, 1919.
- March 8, 1920 to June 2, 1920.

Pamphlets explaining the use of these tables and giving specimen observations have been printed in English and in French.

Magnetic Surveys.

Thirty-nine surveyors were instructed to observe for magnetic declination, and during the surveys made by R. C. Purser, D.L.S., and E. S. Martindale, D.L.S., observations for magnetic dip and total force were taken at twenty-four stations. The instrumental constants of the dip circles as determined at Agincourt both at the beginning and end of the survey season show a probable error of less than 0.00010 c.g.s., in each case from the mean of at least six observations. At every station a complete observation for magnetic dip and total force, consisting of a dip, a total force, a dip, a total force, a dip, a total force and a dip, was taken. The average range was found to be comparatively small.

The index correction to the compass of every transit used for observing was determined both at the beginning and end of the survey season. If the change was small, the mean correction was used in the reduction of the observations. If a serious discrepancy was found between the two determinations it was investigated, and if the discrepancy could not be satisfactorily explained the observations taken with the instrument were rejected. The observations have been reduced by means of the continuous photographic records of the declinometer at Meanook, Alta.

Declination observations received for 1917.. . . .	1,306
Previous returns since 1908.. . . .	11,300
Total returns to date.. . . .	12,606
Dip observations received for 1917.. . . .	99
Previous returns since 1908.. . . .	599
Total returns to date.. . . .	698
“ force observations received for 1917.. . . .	74
Previous returns since 1908.. . . .	437
Total returns to date.. . . .	511

Surveys Laboratory.

Complete tests were made of seven D.L.S., subdivision transits, twenty clinometers, and five aneroid barometers. Partial tests were made of one hundred subdivision transits and one level. Nine optical tests were made of transit telescopes and eye-pieces and adjustments made to four surveying cameras.

Fourteen sidereal watches were submitted for trial and passed through complete tests in accordance with the Bureau of Standards method for a Class A certificate. Four out of the fourteen, that is 29 per cent, passed the test.

Ninety-six stadia cards were computed, printed, and issued to the surveyors.

At the Comparator building, the lengths and weights of twenty-four tapes of all kinds were determined and comparisons made of four standard scales and five office

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scales. Fifteen inter-comparisons of the laboratory standards and three hundred and fifty comparisons of the standards with the base were made.

The comparator base was verified fifty-five times by the standard four-metre rule.

The work done at the Surveys Laboratory is given in more detail on page 32.

Surveying Instruments.

Repairs were made to sixty-two transit theodolites, forty-five levels, forty-eight stadia rods, six precise level rods, three surveying aneroids, twelve surveying cameras, seven instrument cases, two kodaks, thirty-two tripods, and ten miscellaneous instruments.

Eleven sidereal watches were overhauled and readjusted.

In connection with the inspection of instruments and outfitting of the surveyors, 275 cases aggregating $7\frac{1}{2}$ tons (15,215 pounds) were shipped from this office and 195 cases aggregating 5 tons (10,450 pounds) received.

A statement of instruments on hand on March 31, 1918, showing also the instruments purchased and sold during the year is given in appendix No. 6.

General Work.

The 450 courses of the retracement made by R. B. McKay, D.L.S., of about 100 miles of the Canadian Pacific Railway traverse were reduced to latitudes and departures, and the errors between the posts tied to were thus computed. A table of the errors in position of these posts was then prepared, the ties to the triangulation stations being used to control the results. Formerly the errors of only a few posts which had been tied to triangulation stations were known, and the results of this survey have confirmed those ties and have shown at what points the errors occurred. Difficulties over the latitudes and longitudes of the interprovincial boundary sheets near the railway and over the positions of monuments in the railway belt itself can now be solved.

PHOTOGRAPHIC DIVISION.

The staff consists of general photographers, and process photographers.

The photographs taken by surveyors in the field to illustrate their reports were developed, printed and indexed by the general photographers. They also developed the plates for the photographic surveys and made the enlargements required for plotting the plans.

About one-half of the time of the process photographers was spent in making wet-plate negatives of plans and maps for reproduction and preparing the zinc plates for lithography. During the other half of the time they were engaged on work for the plotting and drafting branches, such as the reduction of the enlargement of plans, copying photographs, etc.

Considerable work has also been done for other branches of the department, for the Printing Bureau, and for other departments.

Below is a summary of the work:—

Dry plates and films.. . . .	1,577
Bromide prints.. . . .	2,148
Velox prints.. . . .	3,634
Vandyke prints.. . . .	176
Blue-prints.. . . .	375
Lantern slides.. . . .	92
Photographs mounted.. . . .	1,679
Wet plate negatives.. . . .	2,124
Photo-litho plates.. . . .	709
Total.. . . .	12,514

LITHOGRAPHIC DIVISION.

This division was organized thirty-seven years ago for the purpose of printing township plans and sectional maps. The peculiarity of this work is that the editions are very small, seldom exceeding two or three hundred, while the number of plans and maps is very large. It was found that commercial firms were not equipped for doing this kind of work and that the delays in getting the plans printed were extremely inconvenient. Land cannot be opened for entry until the official plan of the township is issued; it can readily be understood that any delay in printing the plan interferes seriously with settlement.

Advantage is taken of the existence of the Lithographic Division for printing the numerous forms used on the surveys and at the head office, the skeleton plans to be inked by draftsmen, the township index, a few topographical or other maps, and general lithographic work for other branches or departments, but the main purpose of the division is to print township plans and sectional maps. The relative importance of the various classes of lithographing is shown by the value, at Printing Bureau rates, of the work for the fiscal year:—

1,036 township plans.. . . .	\$35,506 90
66 sectional maps.. . . .	5,344 11
173 sundry lithographic jobs.. . . .	20,590 46
	<hr/>
	\$61,441 47

In the above estimate, paper is put in at cost, \$5,041.70. Paper had at the time increased 50 per cent and would have been charged at the increased price had the work been given out to the trade.

The actual cost to the Government, taking into account rent of buildings, power and light, heating, cleaning, firemen, caretaker, interest on plant, depreciation and fire insurance, is as follows:—

Process photographers.. . . .	\$ 7,212 92
Lithographers.. . . .	23,922 77
	<hr/>
Total cost.. . . .	\$31,135 69
Value of work at Printing Bureau rates.. . . .	61,441 47
	<hr/>
Profit.. . . .	\$30,305 78

It is thus seen that the cost is about one-half of what would have been paid if the work had been given out at Printing Bureau rates. It might be thought that the Bureau rates are excessive, but such is not the case. Careful inquiry has established the fact that they allow no more than a fair margin of profit. The explanation of the results obtained is to be found in the perfection of our equipment and the efficiency of our organization.

CHIEF INSPECTOR OF SURVEYS.

The staff of the Chief Inspector of Surveys has been engaged in collecting information on the districts and townships suitable for the settlement of returned soldiers. An examination was made of the survey records in the department; information was collected from the different surveyors, maps, reports, etc., and it was furnished to the Soldiers Settlement Board to assist in placing returned soldiers on the land.

BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS.

The Board of Examiners for Dominion Land Surveyors held three meetings. The first was a special meeting lasting from April 30 to May 25 (inclusive), 1917, during which examinations were held at Ottawa and Calgary. The second was another special meeting which took place on October 19, 1917. The third was the regular annual

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meeting called for by section 9 of the Dominion Lands Surveys Act. It began on Monday, February 11, 1918 and lasted until March 13, 1918. During this meeting examinations were held at Ottawa and Calgary. The total number of candidates for examination was 54. Of these 39 tried the preliminary examination and 15 tried the final examination.

Eight candidates were successful at the preliminary examinations as follows:—

Preliminary Examination.

1. Adams, Albert Oliver, Ottawa, Ontario.
2. Ahern, Philip Charles, Ottawa, Ontario.
3. Ingersoll, John Nelson, Ottawa, Ontario.
4. Markham, Edwin, Regina, Saskatchewan.
5. Salton, George H., Ottawa, Ontario.
6. Spratt, Maynard J., Ottawa, Ontario.
7. Webster, R. C. Peter, Ottawa, Ontario.
8. Whittaker, David, Beaver Mines, Alberta.

Eleven candidates were successful at the final examination as follows:—

Final Examination.

1. Dunn, Thomas Hamilton, Ottawa, Ontario.
2. French, Merritt Henry, Calgary, Alberta.
3. Harris, Ley Edwards, Calgary, Alberta.
4. Howe, John Parnell, Pembroke, Ontario.
5. Lyon, John Edward, Ottawa, Ontario.
6. Ney, Cecil Herman, Toronto, Ontario.
7. Patterson, John Herbert, Kinosota, Manitoba.
8. Prinsep, Garnet T., Ottawa, Ontario.
9. Read, Hiram Earl, Edmonton, Alberta.
10. Wing, Daniel Oscar, Montreal, P.Q.
11. Wright, James Goldwin, Valleyfield, P.Q.

The time of the board during the meetings, was largely taken up with the reading and valuation of the candidates' answer-papers. Complete sets of question papers, to be used at the next examination, were also prepared. In addition to this the evidence submitted by candidates at the final examination, in proof of their eligibility therefor, had to be examined. This evidence consisted of certificates of Provincial land surveyors and of affidavits of service under articles of apprenticeship.

The board had to consider several applications from college and university graduates asking to be admitted to the privileges of section 22 of the Surveys Act, which provides for a shorter term of service under articles.

Eleven commissions were issued to candidates who had passed the final examination and had furnished oaths of office and allegiance and bonds for the sum of one thousand dollars, as required by section 25, of the Dominion Lands Surveys Act.

Ten certificates of preliminary examination were issued to successful candidates who had complied with the requirements of the law.

Section 35 of the Dominion Lands Surveys Act provides that every Dominion land surveyor shall be in possession of a subsidiary standard length. Nine new standards were issued to surveyors and two measure which had previously been supplied were tested by the department.

It was represented by a large number of Dominion land surveyors that it was very inconvenient for them to take the D.T.S. examination which has heretofore been held annually in February as in a great many cases the review of the work had to be done after the completion of the regular season in the field which afforded them little time for preparation.

Under the circumstances the Board of Examiners have deemed it advisable to postpone the D.T.S. examination to the date of the special sitting of the Board which is held every spring, usually early in May.

The Board of Examiners passed a resolution to the effect that during the continuance of the war, the fees connected with the examination and payable to the secretary, shall not be exacted from returned soldiers or from any person who has attempted to enlist but has been rejected for physical reasons.

SURVEYS LABORATORY.

The work at the laboratory during the year has continued to be affected by conditions arising out of the war. Regular routine testing work has been the main occupation of the staff, with such special investigations and research as the reduced numbers and other conditions would permit. As in the past, lack of space has been a serious handicap in the carrying on of certain branches of the work and this becomes more acute year by year. The following is a brief outline of the work accomplished.

Metrology.—In accordance with the policy of obtaining data relative to the permanency of the laboratory standard tapes and the variation of the base, the regular weekly base determinations and standard tape comparisons have been continued throughout the year. Three holes have been drilled in the concrete monolith one at the centre and the others at about 8^m and 24^m from the zero end. Thermometers, placed in these holes enable the temperature of the monolith to be observed. This additional information should enable the degree of relationship between the length of the base and its temperature to be established.

In comparing the 4^m rule with the one metre standard, it is necessary to apply a small correction to the sum of the lengths of the four single metres, owing to the natural flexure of the 4^m rule, and also a slight curvature in the horizontal plane. The correction was computed from the measurements of the relative inclinations of the four one-metre chords of the 4^m rule, made optically by utilizing two collimators.

New bench-marks have been installed on the piers of the comparator base. The graduations on these are very fine, and the rulings being spaced at only 0.1^{mm} apart, the accurate determinations of tape lengths by direct estimation of the interval between the tape and bench-mark graduations are greatly facilitated.

New thermometer-supporting guards of neat design have been installed along the track of the base. These, while affording ample protection to the thermometers, hold them close to the tape under test. A further improvement has been effected in the provision of sliding suspension racks for the standard tapes. These permit of the tapes being easily handled when the racks are lowered, while at other times they are raised so that the hanging tapes will not hamper the movement of the workers.

Transits, Levels, etc.—The usual volume of regular tests and inspections has been carried out.

In this section a large number of telescopes are tested annually. It is desirable that telescopes of various sizes and powers may be classified in such a manner that will show at once the performance to be expected. Several different methods of test are used elsewhere, but as far as known none of these is entirely suitable for the class of work undertaken by the laboratory. A series of investigations and experimental work with the object of determining such a standard have recently been completed. The results of these investigations were successful in that the laboratory now has a method of testing telescopes suitable for surveying instruments and other purposes. A separate pamphlet, "Bulletin No. 41—Tests of Small Telescopes at the Laboratory of the Dominion Lands Surveys," has been published describing the method and also the investigations which led up to its development.

Thermometers.—Besides the usual ice point determination for the "verre dur" thermometers, used in the metrological building, these thermometers were intercompared among themselves, and with a standard thermometer recently tested by the Bureau of Standards, Washington. The comparisons which were made in the thermometer comparator confirmed the corrections originally found for these thermometers at the National Physical Laboratory.

Aneroids.—Aneroids are now regularly tested by the methods followed by the Bureau of Standards. Some investigations have been commenced which it is hoped

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will show whether any improvement can be made in the test, principally having in mind the class of work for which the aneroids tested at the laboratory are to be used.

Watches.—Fourteen watches passed through the Surveys Laboratory test which is similar to that of the Bureau of Standards for a Class A certificate. Four, that is 29 per cent, passed the test.

The results of the trials of the watches which passed are tabulated below.

Results of Watch Tests.
(Bureau of Standards Method.)
Passed.

Name.	Maximum values allowable.	Waltham Watch Co.				Means.
Number of watch.....		T.S. 802	18028596	18028568	18028542	
Escapement, balance spring, etc.....		D.r., g.b., l.e., s.o.	D.r., g.b., l.e., s.o.	D.r., g.b., l.e., s.o.	D.r., g.b., l.e., s.o.	
Mean deviation of daily rate.....	0s.75	0.38	0.50	0.38	0.48	0.43
Mean of daily rates for each pair of position tests.....		+4.56	+3.57	+0.85	−0.08	2.26
Deviation for change of position.....	3s.0	1.58	1.20	2.16	2.28	1.80
Maximum difference between mean rates of position tests.....	10s.0	5.74	4.40	9.44	7.55	6.78
Difference between mean rates of P.U. and D.U. positions.....	5s.0	1.80	0.98	3.72	2.92	2.35
Difference between mean rates of D.U. and D.D. positions.....	4s.0	0.60	0.01	0.77	0.74	0.53
Progressive change of rate for position tests.....	3s.0	+0.47	+0.32	−0.48	+0.65	0.48
Recovery of rate.....	6s.0	+0.30	−0.16	−1.57	+4.93	1.74
Change of r. per 1° C.— A						
4:4–18:3.....		−0.14	−0.18	−0.26	−0.09	0.17
B						
4:4–32:2.....	0s.20	0.00	−0.05	−0.13	+0.05	0.06
Algebraic difference between A and B...	0s.3	0.14	0.14	0.14	0.14	0.14
Isochronism error.....	3s.0	+1.3	+0.2	+0.9	+1.0	0.8
Relative performance.....		60.0 p.c.	56.7	44.8	38.3	

D.r. = Double roller; g.b. = Going barrel.
l.e. = Lever escapement; s.o. = Single overcoil.
P.U. = Pendant up; D.U. = Dial up; D.D. = Dial down.

For the four watches which passed the test, the average variation of daily rate for the position and temperature tests were as follows:—

Position Tests.					Temperature Tests.		
P. U. 90 F. 0s.39	P. R. 90 F. 0s.65	P. L. 90 F. 0s.60	D. U. 90 F. 0s.35	D. D. 90 F. 0s.38	D. U. 40 F. 0s.30	D. U. 65 F. 0s.40	D. U. 90 F. 0s.24

The smallest mean deviation of daily rate was 0s.38, as compared with 0s.23 in 1916 and 1917.

The average errors for position were:—

P.U.	P.R.	P.L.	D.U.	D.D.
2s.48	3s.15	2s.55	0s.35	0s.47

The smallest mean deviation for changes of position was 1s.20, as compared with 0s.66 in 1917 and 0s.75 in 1916.

Comparing the average errors with those for 1916 and 1917 we have the following:—

	1916.	1917.	1918
	S.	S.	S.
Average mean deviation of daily rate.....	0.49	0.36	0.43
“ “ “ for change of position.....	2.08	1.79	1.80
“ change of daily rate per degree centigrade.....	0.09	0.09	0.06

The average isochronism error for the four watches passing test was 0s.8, and the average marks obtained 50.0; the highest 60.0.

Of the watches which failed, two, or 20 per cent failed in position only; one, or 10 per cent failed in temperature correction only, and one, or 10 per cent, in deviation of daily rate only. The remaining six, or 60 per cent, failed to pass more than one tolerance. Of the latter, four, or 40 per cent of the total failures, failed in both position and temperature correction.

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APPENDIX No. 1.

AREA OF SURVEYED LAND IN MANITOBA, SASKATCHEWAN, AND ALBERTA.

Period.	Acres.	Number of Farms of 160 Acres each.
Previous to June, 1873.....	4,792,292	29,952
1874.....	4,237,864	26,487
1875.....	665,000	4,156
1876.....	420,507	2,628
1877.....	231,691	1,448
1878.....	306,936	1,918
1879.....	1,130,482	7,066
1880.....	4,472,000	27,950
1881.....	8,147,000	50,919
1882.....	10,186,000	63,662
1883.....	27,234,000	170,212
1884.....	6,435,000	40,218
1885.....	391,680	2,448
1886.....	1,379,010	8,620
1887.....	643,710	4,023
1888.....	1,131,840	7,074
1889.....	516,968	3,231
1890.....	817,075	5,106
1891.....	76,560	476
1892.....	1,395,200	8,720
1893.....	2,928,640	18,304
1894.....	300,240	1,876
1895.....	406,240	2,539
1896.....	506,560	3,166
1897.....	428,640	2,679
1898.....	859,840	5,374
1899.....	1,022,720	6,392
1900 (first 6 months).....	735,480	4,596
1900-1901.....	1,603,680	10,023
1901-1902.....	2,553,120	15,957
1902-1903.....	6,173,440	38,584
1903-1904.....	12,709,600	79,435
1904-1905.....	10,671,520	66,697
1905-1906.....	4,973,920	31,087
1906-1907 (9 months).....	3,819,700	23,873
1907-1908.....	6,123,040	38,269
1908-1909.....	7,412,870	46,330
1909-1910.....	7,423,200	46,395
1910-1911.....	5,683,200	35,520
1911-1912.....	5,146,080	32,163
1912-1913.....	5,155,520	32,222
1913-1914.....	5,193,280	32,458
1914-1915.....	4,484,960	28,031
1915-1916.....	3,112,640	19,454
1916-1917.....	2,221,280	13,883
1917-1918.....	1,323,360	8,271
	177,583,585	1,109,892

APPENDIX No. 2.

SCHEDULE of Surveyors employed and work executed by them.

Akins, J. R., St. Catharines, Ont.—

Survey of the 28th base line between the Fourth and Fifth meridians.

Bennett, G. A., Tillsonburg, Ont.—

Stadia surveys in tps. 29 and 30-9-3; tps. 29 and 30-10-3; tps. 29 and 30-11-3; tps. 23 to 30-12-3; tps. 23 to 28-13-3; tps. 21 to 30-14-3; tps. 21 to 29-15-3; tps. 21 to 30-16-3; tps. 17, 18, and 22 to 30-17-3; tps. 17, and 23 to 26-18-3; tps. 16, 17, 19, 20, 21, and 23 to 26-19-3; tps. 16 to 26-20-3; tps. 16 to 26-21-3; tps. 21 to 26-22-3; tps. 21 to 26-23-3; tps. 17 to 26-24-3; tps. 18 to 26-25-3; tps. 18 to 26-26-3; tp. 18 to 23-27-3; tps. 18 to 23-28-3; tps. 17 to 23-29-3; tp. 18-30-3; tp. 22-1-4.

Blanchet, G. H., Ottawa, Ont.—

Survey of the 21st base line across ranges 17 to 26; the 22nd base line across ranges 18 to 26; and the 23rd base line across ranges 20 to 26, all west of the Third meridian. Survey of part of north outlines of tp. 80-16-3; tp. 84-17-3; tp. 88-19-3.

Boulton, W. J., Wallaceburg, Ont.—

Stadia surveys in tps. 8 to 14-22-4; tps. 8 to 14-23-4; tps. 8 to 14-24-4; tps. 8 to 14, 18, 20, 21, and 22-25-4; tps. 8 to 14, 20, and 21-26-4; tps. 9 to 14, 19, 20, and 21-27-4; tps. 9 to 12, and 19-28-4.

Bridgland, M. P., Calgary, Alta.—

Photo-topographical surveys in Bow River forest reserve.

Brenot, L., Ottawa, Ont.—

Partial subdivision of tps. 85 and 86-18-6; tps. 85 and 86-19-6; and tps. 84, 85 and 86-20-6.

Buchanan, J. A., Edmonton, Alta.—

Subdivision of tps. 91 and 93-22-5; tp. 90-23-5; tp. 92-24-5. Partial subdivision of tps. 89, 91 and 94-23-5; tps. 89 and 93-24-5.

Calder, J. A., Lytton, B.C.—

Subdivision in tps. 20 and 21-24-6; tp. 6-25-6; tps. 21 and 22-26-6; tp. 21-27-6; tps. 3 and 4-28-6; tp. 3-3-7; and tp. 18 E.C.M. Retracement in tps. 20 and 21-24-6; tp. 6-25-6; tps. 21 and 22-26-6; tp. 21-27-6; tp. 3-28-6; and tp. 18 E.C.M. Traverse in tp. 6-25-6; tp. 21-27-6; tp. 21-26-6; tp. 3-3-7; and tp. 18 E.C.M.

Christie, W., Prince Albert, Sask.—

Subdivision of tps. 55 and 56-24-2; tps. 55 and 56-25-2; tp. 56-26-2. Partial subdivision of tp. 54-24-2; tp. 54-25-2.

Cote, J. M., Ottawa, Ont.—

Resurvey of tp. 20-11-3; tps. 20 and 21-12-3; tps. 20, 21 and 22-13-3; tp. 21-14-3. Part resurvey of tp. 43-2-3; tp. 43-3-3; tp. 19-12-3; tp. 19-13-3; tp. 22-14-3. Traverse of Connell and Harehill creeks in tps. 48 and 49-10-2.

Cowper, G. C., Welland, Ont.—

Stadia surveys in tps. 1 to 4-1-3; tps. 1 to 4-2-3; tps. 1 to 4-3-3; tps. 1 to 6-4-3; tps. 1 to 6-5-3; tps. 1 to 6-6-3; tps. 1 to 6-7-3; tps. 1 to 10-8-3; tps. 1 to 10-9-3; tps. 1 to 10-10-3; tps. 1 to 10-11-3; tps. 1 to 10, 12-3; tps. 1 to 10-13-3; tps. 1 to 10-14-3; tps. 1 to 10-15-3; tps. 1 to 10-16-3; tps. 1 to 10-17-3; tps. 1 to 9-18-3; tps. 1 to 7-19-3; tps. 1 to 6-20-3; tps. 3, 4, 5 and 7 to 10-21-3; tps. 7 to 10-22-3; tps. 9 and 10-23-3; tp. 10-24-3.

Davies, T. A., Edmonton, Alta.—

Stadia surveys in tps. 45, 52, and 53-1-4; tps. 45, 52 and 53-2-4; tps. 45 and 46-3-4; tps. 43, and 46 to 53-4-4; tps. 41, 42, and 47 to 53-5-4; tps. 45 to 53-6-4; tps. 45, 46, and 48 to 53-7-4; tps. 44, 45, and 48 to 52-8-4; tps. 43 and 48 to 51-9-4.

Deans, W. J., Brandon, Man.—

Subdivision of the dried-up bed of Shoal lake; traverse of the lake and retracement in tps. 15 and 16-1-Pr; tps. 15, 16, and 17-2-Pr; and tp. 19-3-Pr. Subdivision of the dried-up bed of Whitewater lake and retracement in tps. 3, 4, and 5-21-Pr; and tps. 3, and 4-22-Pr. Resurvey in tp. 1-13-E, and tp. 18-1-Pr. Survey of lot at Bull head point in tp. 30-6-E.

SESSIONAL PAPER No. 25a

Evans, S. L., Corinth, Ont.—

Resurvey in tp. 26-23-2; tps. 47 and 48-1-3; tp. 34-5-3; tp. 50-17-3. Restoration survey in tp. 49-5-3; tp. 43-7-3; tp. 48-8-3; tp. 46-22-3. Retracement in tp. 28-19-2; tp. 24-21-2; tp. 39-22-2; tp. 27-23-2; tps. 43, 44, and 49-26-2; tp. 32-4-3; tp. 33-5-3; tp. 48-7-3; tp. 46-16-3; tp. 50-18-3; tp. 47-19-3; tp. 45-21-3; tp. 49-22-3; tp. 46-23-3. Correction survey in tp. 51-1-3; tp. 31-2-3; tp. 33-6-3; tp. 44-7-3; tp. 44-8-3; tp. 49-15-3; tp. 47-16-3; tp. 49-17-3; tp. 29-20-4. Traverse in tp. 51-27-2; tp. 42-15-3. Survey of school site in tp. 30-17-3.

Fawcett, S. D., Ottawa, Ont.—

Subdivision of tp. 81-13-6. Part subdivision of tp. 82-13-6; tps. 81 and 82-14-6; tps. 81 and 82-15-6; tps. 81 and 82-16-6; tp. 78-19-6. Retracement in tp. 79-16-6; tp. 79-17-6.

Fontaine, L. E., Levis, Que.—

Correction surveys in tp. 87-13-4; tp. 87-14-4; tps. 81 to 84-16-4; tps. 80 to 86-17-4; tp. 92-22-5; tps. 91 to 93-23-5; tp. 93-24-5; tp. 89-25-5; east outlines of tp. 90-25-5 and tp. 90-26-5. Correction of lot monuments in Pelican settlement. Traverse in tps. 85 and 86-16-4.

Galletly, J. S., Oshawa, Ont.—

Subdivision in tp. 61-29-Pr; tp. 61-30-Pr; tp. 54-31-Pr; tps. 53 and 54-1-2; tps. 53 and 54-2-2; tp. 53-3-2; tps. 52 and 53-4-2; tp. 52-5-2; tps. 52 and 53-6-2. Survey of Lot 7 in tp. 56-26-Pr., and of Sturgeon settlement in tp. 61-30-Pr.

Glover, A. E., Edmonton, Alta.—

Surveys in tp. 55-8-4; tp. 47-8-5; tp. 77-24-5. Traverse in tp. 63-2-4; tp. 56-9-4; tps. 58 and 61-10-4. Retracement surveys in tp. 44-28-3; tp. 42-1-4; tps. 42 and 56-3-4; tp. 37-5-4; tp. 39-6-4; tp. 39-7-4; tp. 38-8-4; tp. 57-18-4; tp. 45-22-4; tp. 53-25-4; tps. 35, 37 and 45-28-4; tp. 58-6-5; tp. 83-5-6; tp. 83-6-6. Correction survey in tps. 37, and 38-28-3; tp. 62-1-4; tp. 44-15-4; tp. 80-26-4; tp. 62-27-4; tp. 71-1-5; tps. 69 and 70-20-5; tp. 69-22-5; tp. 80-1-6; tps. 70, 71, and 74-12-6.

Jackson, J. E., Hamilton, Ont.—

Subdivision of tps. 36 and 37-5-Pr; tp. 36-6-Pr; tp. 36-7-Pr; tp. 36-8-Pr. Part subdivision of tp. 35-5-Pr; tps. 35 and 37-6-Pr; tps. 33, 34, and 35-7-Pr.

Johnston, J. H., Peace River, Alta.—

Subdivision of tps. 69 and 70-1-6; tps. 69, 70, and 71-2-6. Part subdivision of tp. 71-1-6; tps. 69, 70, and 71-3-6. Part resurvey of the N. by tp. 70-4-6.

Johnston, W. J., St. Catharines, Ont.—

Subdivision in tps. 20 and 21-11-6; tps. 17 to 20-12-6; and tps. 18 to 22-13-6. Retracement in tp. 21-11-6; tps. 18, 19, and 20-12-6; and tps. 19 and 21-13-6.

King, J. A. S., Ottawa, Ont.—

Stadia surveys in tp. 38-19-3; tps. 37, 38, and 40 to 44-21-3; tps. 37 to 44-22-3; tps. 37 to 44-23-3; tps. 37 to 44-24-3; tps. 37 to 44-25-3; tps. 42 to 44-26-3; tps. 43 to 45-27-3; tps. 42 to 44-28-3.

Knight, R. H., Edmonton, Alta.—

Subdivision of tps. 85 and 86-6-4. Part subdivision of tps. 87 and 88-6-4; tps. 86 to 89-7-4; tps. 85 to 87-8-4.

LeBlanc, P. M. H., Ottawa, Ont.—

Stadia surveys in tp. 48-15-2; tps. 42 to 50-16-2; tps. 42 to 50-17-2; tps. 46 to 48-18-2; tps. 46 to 48-19-2; tp. 48-20-2; tps. 47 and 48-21-2; tps. 47 and 48-22-2; tps. 45 to 48-23-2; tps. 45, 46, and 47a-24-2; tp. 48-24a-2; tps. 44, 46a, and 47a-25-2; tps. 44, 45, 45a, and 46a-26-2; tps. 44, 45a, and 46a-27-2.

Lighthall, A., Vancouver, B.C.—

Subdivision of tp. 73-1-6; tps. 73 to 76-2-6. Part subdivision of tp. 74-3-6.

Lonergan, G. J., Buckingham, Que.—

Inspection of subdivision parties under W. J. Deans, D.L.S., and J.E. Jackson, D.L.S. Inspection of railway belt surveys under J. A. Calder, D.L.S., W. J. Johnston, D.L.S., N. C. Stewart, D.L.S., and C. H. Taggart, D.L.S. Inspection of stadia surveys under W. J. Boulton, D.L.S., G. C. Cowper, D.L.S., T. A. Davies, D.L.S., J. A. S. King, D.L.S., P. M. H. LeBlanc, D.L.S., P. J. McGarry, D.L.S., W. H. Norrish, D.L.S., C. Rinfret, D.L.S., H. M. R. Soars, D.L.S., and C. M. Walker, D.L.S. Inspection of miscellaneous surveys under J. M. Cote, D.L.S., S. L. Evans, D.L.S., L. E. Fontaine, D.L.S., and R. B. McKay, D.L.S.

Martindale, E. S., Aylmer, Ont.—

Survey in tp. 1-19-2; tp. 27-7-4; tp. 20-9-4. Retracement in tp. 14-8-2; tp. 18-15-2; tp. 26-27-2; tp. 26-28-2; tp. 14-5-3; tp. 25-9-3; tp. 25-10-3; tp. 11-18-3; tps. 13 and 23-1-4; tp. 17-5-4; tp. 17-6-4; tps. 10 and 11-19-4; tps. 8, 10, and 11-20-4; tps. 10 and 11-21-4; tp. 12-24-4. Correction survey in tp. 6-18-2; tp. 11-23-2; tp. 6-3-3; tps. 22 and 23-7-3; tp. 21-8-3; tp. 22-12-3; tp. 20-17-3; tp. 15-19-3; tps. 8 and 11-23-3; tp. 23-25-3; tp. 26-28-3; tp. 1-29-3; tps. 14 and 15-5-4; tp. 21-9-4. Resurvey in tp. 12-29-2. Establishment of monuments in tp. 10-5-3; tp. 22-8-3; tp. 13-23-3; tp. 5-29-3. Subdivision at Sandilands station in tp. 4-9-E. Survey of the townsite of Drumheller in tp. 29-20-4.

9 GEORGE V, A. 1919

McEwen, D. F., Edmonton, Alta.—

Subdivision of tps. 61, 62, and 63-9-5; tps. 61 and 62-10-5. Part subdivision of tp. 64-9-5; tp. 61-11-5.

McGarry, P. J., Merritton, Ont.—

Stadia surveys in tps. 35 to 42, and 42a-1-3; tps. 36 to 42, and 43a-2-3; tps. 34 to 43, 43a, 44 and 45-3-3; tps. 35 to 46-4-3; tps. 39 to 46-5-3.

McKay, R. B., Vancouver, B.C.—

Traverse of Canadian Pacific railway right-of-way from Morley to Ottertail. Retracement of the 2nd base line across ranges 1 to 14 west of the Fourth meridian.

Norrish, W. H., Ottawa.—

Stadia surveys in tps. 40 and 41-19-4; tps. 39 to 42-20-4; tps. 40 to 42-21-4; tps. 40 to 43-22-4; tps. 41 to 43-23-4; tps. 41 to 43-24-4; tp. 42-25-4.

Narraway, A. M., Ottawa.—

Inspection of subdivision surveys under L. Brenot, D.L.S., J. A. Buchanan, D.L.S., W. Christie, D.L.S.; S. D. Fawcett, D.L.S., J. S. Galletly, D.L.S., J. E. Jackson, D.L.S., J. H. Johnston, D.L.S., R. H. Knight, D.L.S., A. Lighthall, D.L.S., L. A. Pierce, D.L.S., C. H. Taggart, D.L.S. Miscellaneous surveys under J. M. Cote, D.L.S.

Pierce, J. W., Pembroke, Ont.—

Subdivision of tps. 30 and 31-4-Pr; tp. 32-5-Pr. Part subdivision of tps. 30, 31 and 32-2-Pr; tps. 30, 31 and 32-3-Pr; tp. 32-4-Pr; tps. 30 and 31-5-Pr.

Plunkett, T. H., Meaford, Ont.—

Survey of the 17th base line across ranges 20 to 31 west of the Principal meridian, and of the east outlines of tps. 63 to 68-30-Pr. Resurvey of part of the east outline of tp. 61-30-Pr.

Purser, R. C., Ottawa, Ont.—

Surveys in tp. 65-2-Pr; tp. 65-3-Pr; tps. 24 and 25-4-Pr; tp. 24-5-Pr; tp. 23-8-Pr; tp. 23-9-Pr; tp. 22-10-Pr; tp. 18-18-Pr. Resurvey in tp. 1-13-E. Retracement in tp. 1-10-E; tp. 17-19-Pr. Correction survey in tp. 3-12-E; tp. 21-6-Pr; tp. 12-31-Pr; tp. 5-32-Pr; tp. 20-8-2; tp. 23-9-2; tps. 20 and 21-13-2; tps. 20 and 21-14-2. Traverse in tps. 24 and 25-4-Pr; tp. 14-6-Pr; tp. 21-5-Pr; tp. 23-8-Pr; tp. 23-9-Pr; tp. 22-10-Pr; tp. 18-18-Pr. Lot survey near Sandilands station in tp. 4-9-E. Survey of school site in tp. 29-21-Pr.

Rinfret, C., St. Stanislas, Que.—

Stadia surveys in tp. 13-33-Pr; tp. 13-34-Pr; tps. 9 to 14-5-2; tps. 9 to 14-6-2; tps. 8, 9, and 13, to 18-7-2; tps. 9 to 16-8-2; tps. 8 to 16-9-2; tps. 10, 15, and 17-10-2; tps. 15, 17 and 18-11-12; tps. 16 and 18-12-2; tps. 15 to 18-13-2. Investigation of water areas in tp. 13-32-Pr; tp. 9-4-2; tps. 8, and 12-5-2; tps. 8, 16, and 17-6-2; tps. 10 to 12-7-2; tps. 8, 17, and 18-8-2; tps. 17 and 18-9-2; tps. 9 and 18-10-2; tp. 17-12-2; tps. 17 and 18-14-2.

Soars, H. M. R., Edmonton, Alberta.—

Stadia surveys in tps. 55 to 58-15-4; tps. 56 and 58-16-4; tps. 56 to 58-17-4; tps. 55 and 56-18-4; tp. 56-19-4; tps. 55 to 58-20-4; tps. 55 to 58-21-4; tps. 55 to 57-22-4; tps. 55 to 58-23-4; tps. 55 to 57-24-4; tps. 55 to 57-25-4; tps. 55 to 57-26-4; tps. 54, 55, and 58-27-4; tp. 54-28-4; tps. 54 to 57-1-5; tps. 54 to 57-2-5; tps. 54 to 56-3-5; tps. 54 and 55-4-5. Investigation in tps. 55 and 57-16-4; tp. 57-17-4; tp. 54-18-4; tp. 55-19-4; tp. 58-22-4; tp. 58-24-4; tp. 58-25-4; tp. 58-26-4; tps. 56 and 57-27-4.

Stewart, N. C., Vancouver, B.C.—

Subdivision in tp. 28-22-5; tps. 21 and 22-1-6; tps. 22 and 23-2-6; tps. 22 and 23-4-6; tp. 23-5-6; tp. 23-6-6; tps. 21 and 22-7-6; and tps. 21 and 22-8-6. Retracement in tp. 22-1-6; tp. 23-2-6; tp. 23-5-6; tps. 21 and 22-7-6. Traverse in tps. 21 and 22-1-6; tps. 22 and 23-2-6; tps. 22 and 23-4-6; tp. 23-5-6; tp. 23-6-6; tps. 21 and 22-7-6; and tp. 22-8-6.

Taggart, C. H., Kamloops, B.C.—

Subdivision surveys in tp. 25-11-6; tps. 16, 17, and 18-14-6; tp. 20-15-6; tp. 18-16-6; and tp. 18-17-6. Retracement in tp. 25-11-6; tps. 17 and 18-14-6; tp. 20-15-6; and tps. 18, 20, and 21-16-6. Traverse in tp. 18-14-6; tp. 20-15-6; and tp. 18-16-6.

Walker, C. M., Ottawa, Ont.—

Stadia surveys in tps. 31 and 32-13-2; tps. 29 and 30-14-2; tps. 31-15-2; tp. 31-16-2; tps. 30 and 31-17-2; tps. 29 and 30-18-2; tps. 30 and 31-19-2; tps. 29 to 32 and 35 to 38-20-2; tps. 29 to 38-21-2; tps. 29 to 35, and 37-22-2; tps. 29 to 34 and 37-23-2; tps. 29 to 38-24-2; tp. 29-25-2. Investigation in tp. 30-13-2; tp. 31-14-2; tp. 31-18-2; tp. 29-19-2; tp. 33-20-2; tps. 30 and 31-25-2.

Wallace, J. N., Calgary, Alta.—

Lines of levels along Grand Trunk Pacific railway from Goodeve to Saskatoon, 172 miles; along Canadian Northern railway from Warman to Margo, 147 miles; along east outline of range 12 west of Fourth meridian from tp. 20 to tp. 55, 216 miles; a line from Ile à la Crosse to Methy lake, 87 miles. Total, 622 miles.

APPENDIX No. 3.

SCHEDULE showing for each surveyor employed the number of miles surveyed of section lines, township outlines, traverses of lakes and rivers, and resurvey; also the cost of the same. Surveyors whose work cannot be reckoned in miles are omitted from the statement.

Surveyor.	Miles of Section Line.	Miles of Outline.	Miles of Traverse.	Miles of Resurvey.	Total Mileage.	Total Cost.	Cost per Mile.
Akins, J. R.....		144			144	\$23,927	\$166 16
Bennett, G. A.....			702	13	715	6,767	9 46
Blanchet, G. H.....		182			182	21,810	119 84
Boulton, W. J.....			1,140		1,140	6,027	6 08
Brenot, L.....	282	45	23		350	17,460	49 89
Buchanan, J. A.....	388	75	73		536	18,962	35 38
Calder, J. A.....	91		8		99	9,932	100 32
Christie, W.....	336	94	51		481	18,000	37 42
Cote, J. M.....			15	565	580	14,551	25 09
Cowper, G. C.....			684	12	696	6,441	9 25
Davies, T. A.....			958		958	6,572	6 86
Deans, W. J.....			107	167	274	7,045	25 71
Fawcett, S. D.....	310	55	52	3	420	20,939	49 85
Galletly, J. S.....	220	42	183		445	15,849	35 62
Jackson, J. E.....	397	36	83		516	16,092	31 19
Johnston, J. H.....	345	72	109	2	528	17,850	33 81
Johnston, W. J.....	154		18		172	10,073	58 56
King, J. A. S.....			697	9	706	6,693	9 48
Knight, R. H.....	323	44	47		414	19,030	45 96
LeBlanc, P. M. H.....			685	12	697	6,671	9 57
Lighthall, A.....	331	58	64		453	18,188	40 15
McEwen, D. F.....	332	76	34		442	17,666	39 96
McGarry, P. J.....			585		585	5,749	9 83
McKay, R. B.....			119	84	203	8,246	40 62
Norrish, W. H.....			733		733	7,216	9 84
Pierce, J. W.....	377	84	36		497	18,595	37 41
Plunkett, T. H.....		120		7	127	20,439	160 94
Rinfret, C.....			479	64	543	6,826	12 57
Soars, H. M. R.....			689		689	6,914	10 03
Stewart, N. C.....	82		20		102	8,709	85 38
Taggart, C. H.....	141		19		160	11,147	69 67
Walker, C. M.....			867	1	868	6,725	7 75
	4,109	1,127	9,280	939	15,455	407,111	26 29

Final returns not all received. Total cost and amount of traverse are estimated.
Total cost includes depreciation of outfit.

APPENDIX No. 4.

LATITUDE OBSERVATIONS IN DOMINION LANDS SURVEYS SYSTEM.

Obs. Station referred to N.E. corner.	Date of Obs.	Number of Obs. and pairs.	Prob-able Error.	Observed Latitude reduced to section corner.	Correct Latitude of corner in D.L. System.	Diff. in seconds.	Position in D.L. System of corner by Obs.
Sec. Twp.				° ' "	° ' "		
24 71-1-5.....	1908	78 Obs. 45 pair	0.08	55 10 12.97	55 10 11.56	1.41	North 2.17 ch.
13 35-1-Pr.....	1911	89 Obs. 72 pair	0.05	52 01 05.61	52 00 48.33	17.28	North 26.55 "
36 48-1-Pr.....	1911	70 Obs. 63 pair	0.07	53 11 31.37	53 11 31.35	0.02	North 0.03 "
1 62-1-4.....	1911	68 Obs. 50 pair	0.06	54 20 27.03	54 20 27.93	0.90	South 1.38 "
12 89-1-4.....	1911	98 Obs. 82 pair	0.05	56 42 39.22	56 42 42.00	2.78	South 4.27 "
13 61-1-2.....	1912	77 Obs. 61 pair	0.06	54 16 59.36	54 16 59.17	0.19	North 0.29 "
13 57-1-3.....	1912	73 Obs. 50 pair	0.07	53 56 01.77	53 56 01.94	0.17	South 0.26 "
13 48-1-6.....	1912	96 Obs. 62 pair	0.06	53 08 56.22	53 08 52.26	3.96	North 6.08 "
13 24-1-5.....	1912	95 Obs. 58 pair	0.05	51 03 10.90	51 03 08.97	1.93	North 2.96 "
24 111-1-5.....	1914	96 Obs. 66 pair	0.05	58 39 34.07	58 39 34.73	0.66	South 1.01 "
1 115-1-4.....	1914	82 Obs. 67 pair	0.05	58 57 57.05	58 57 55.00	2.05	North 3.15 "
1 80-1-6.....	1914	110 Obs. 76 pair	0.05	55 54 43.13	55 54 41.17	1.96	North 3.01 "
36 88-1-6.....	1914	106 Obs. 79 pair	0.05	56 40 59.81	56 40 55.44	4.37	North 6.72 "
36 32-1-4.....	1915	111 Obs. 72 pair	0.03	51 47 40.45	51 47 41.19	0.74	South 1.14 "
36 32-1-3.....	1915	110 Obs. 70 pair	0.03	51 47 40.99	51 47 41.42	0.43	South 0.66 "
36 32-1-2.....	1915	111 Obs. 68 pair	0.03	51 47 44.10	51 47 41.64	2.46	North 3.78 "
36 16-7-E.....	1915	100 Obs. 69 pair	0.06	50 24 57.61	50 24 54.16	3.45	North 5.30 "
31 36-5-Pr.....	1915	115 Obs. 67 pair	0.04	52 08 40.25	52 08 39.54	0.71	North 1.09 "
33 28-5-E.....	1915	128 Obs. 80 pair	0.03	51 27 02.49	51 26 44.61	17.88	North 27.47 "
36 25-9-E.....	1915	123 Obs. 67 pair	0.03	51 11 05.65	51 11 01.43	4.22	North 6.48 "
132 60-21-Pr.....	1915	117 Obs. 76 pair	0.03	54 14 25.97	54 14 22.49	3.48	North 5.35 "
13 74-1-Pr.....	1915	113 Obs. 72 pair	0.03	55 25 04.84	55 25 04.55	0.29	North 0.45 "
12 68-1-3.....	1915	113 Obs. 69 pair	0.05	54 52 47.28	54 52 45.54	1.74	North 2.67 "

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APPENDIX No. 5.

DETAILS OF OFFICE WORK.

Sketches, maps, and tracings.. . . .	3,962
Descriptions of irregular parcels of land.. . . .	20
Returns of survey examined—	
Township subdivision.. . . .	172
Township outline.. . . .	166
Stadia plots.. . . .	1,159
Townships investigated for water areas.. . . .	759
Road and railway plans.. . . .	701
Yukon lots and miscellaneous surveys.. . . .	6
Mineral claims.. . . .	166
Timber berths.. . . .	5
Correction and other miscellaneous surveys.. . . .	164
Preliminary township plans.. . . .	100
Township and miscellaneous plans compiled.. . . .	793
“ “ “ issued.. . . .	1,036
Sectional maps issued (three miles to 1 inch)—	
New maps.. . . .	4
Revised maps.. . . .	10
Photographic work—	
Dry plates and films.. . . .	1,577
Prints.. . . .	6,333
Lantern slides.. . . .	92
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APPENDIX No. 6.

SURVEYING INSTRUMENTS ON HAND MARCH 31, 1918.

Instruments.	In Store April 1917.	Pur- chased.	Balance.			Remarks.
			Sold.	Loan.	Store.	
Abney levels.. . . .	35		7	1	26	1 struck off
Alidades.. . . .	1				1	
Altazimuths.. . . .	1				1	
Aneroids.. . . .	91			13	78	
Artificial horizons.. . . .	4			1	3	
Base line apparatus.. . . .	1				1	
Cameras and kodaks.. . . .	18			5	13	
Chronometers and sidereal watches.. . . .	54	4	3	4	51	
Compasses.. . . .	34				34	
Current meters and logs.. . . .	3				3	
Dip circles.. . . .	2			1	1	
Field glasses and binoculars.. . . .	6			4	2	
Levels.. . . .	52			12	40	
Levelling rods.. . . .	79	25		21	82	1 struck off
Micrometer telescopes.. . . .	8				8	
Optical squares.. . . .	1				1	
Pedometers.. . . .	2			2		
Photo-theodolites.. . . .	5				5	
Plane tables.. . . .	1				1	
Protractors.. . . .	77			16	56	5 struck off
Rod levels.. . . .	20	2		2	18	2 “
Sextants and reflecting circles.. . . .	3				3	
Solar compasses.. . . .	2				2	
Stadia rods.. . . .	34	3	9	2	25	1 struck off
Stadia slide rules.. . . .	61			6	54	1 “
Steel tapes.. . . .	138	59	26	9	151	11 “
Subsidiary standard measures.. . . .	79		8		71	
Survey pickets.. . . .	2				2	
Surveying cameras.. . . .	4				4	
Tally registers.. . . .	12				12	
Tape stretching apparatus.. . . .	1				1	
Telemeters.. . . .	1			1		
Thermometers.. . . .	12	27	22	10	6	1 struck off
Transit theodolites.. . . .	67		5	53	9	
Zenith telescopes.. . . .	1				1	

ANADA

1917